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RADIO NEWS

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July
1922

Over 125 Illustrations

Edited by H. GERNSBACK

CIRCULATION LARGER THAN ANY OTHER RADIO MAGAZINE

CUNNINGHAM

TUBES
for
HOME RADIO EQUIPMENT

"AMPLIFIES AS IT DETECTS"

INSIST on Cunningham Tubes. Nationally recognized as the ideal Detector or Amplifier Tubes for use with Radio Receiving Sets, Cunningham Tubes today are the choice of those who want the finest results from their equipment.

In the great General Electric Laboratories, which are equipped with the finest manufacturing devices known to science today, skilled workmen build Cunningham Tubes to the most rigid specifications. Without thought of expense, the smallest detail is carried out that could possibly improve the quality of these tubes. The remarkable results that are obtained through the use of Cunningham Tubes comes as the result of the extraordinary care and skill that is used in their manufacture.

By actual tests made throughout the country, all makes of Radio Receiving Sets when used with Cunningham Tubes give clearest and best results. Your nearest dealer will give you further information or write to us direct.

Type C-300
$5.00

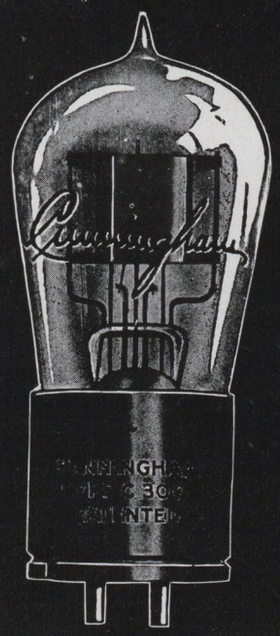
PATENT NOTICE

Cunningham tubes are covered by patents dated 11-7-05, 1-15-07, 2-18-08, and others issued and pending. Licensed only for amateur or experimental uses in radio communication. Any other use will be an infringement.

E. T. Cunningham

Trading As

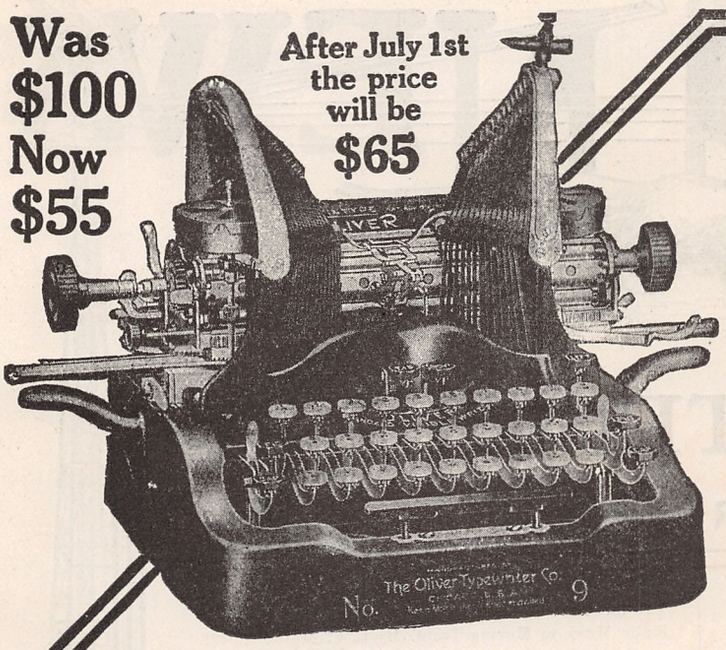
AUDIOTRON MFG. COMPANY
248 First Street
San Francisco, Cal.
154 W. Lake Street
Chicago, Illinois



The trademark GE is the guarantee of these quality tubes. Each tube is built to most rigid specifications.

Was $100 Now $55

After July 1st the price will be $65



$4 A Month Pays for the Latest and Finest Oliver

Your Last Chance to Save $45

The present price of $55 has proved impossible. So to maintain Oliver quality, we announce, with fair warning, that after July 1st, the price will be $65. If you act quickly, you can take advantage of the present saving of $45. But note that the coupon has to be mailed at once.

Here is the present offer:

Price $55. Over a year to pay! Only $4 a month. Payments so small as to average only about 13 cents a day. That is our easy payment plan on the Oliver. And you have the use of the typewriter while you are paying for it. You may now order direct from The Oliver Typewriter Company and get the latest model Oliver at a saving of $45 and on payments so easy that you won't miss the money.

A full saving to you of $45 on the famous Oliver No. 9—our latest and newest model. That is what our new selling plan makes possible. During the war we learned many lessons. We found that it was unnecessary to have such a vast number of traveling salesmen and so many expensive branch houses. We were able to discontinue many other superfluous sales methods. As a result, $55 now buys the identical Oliver formerly priced at $100.

Try It Free—Send No Money

Not a cent in advance. No deposit of any kind. No obligation to buy. The coupon is all you need send. The Oliver comes to you at our risk for five days free trial in your own home. Decide for yourself whether you want to buy or not.

If you don't want to keep the Oliver, simply send it back at our expense. If you do agree that it is the finest typewriter, regardless of price, and want to keep it, take a year and a half to pay at the easy rate of only $4 a month.

Only the Coupon!

No pre-payment required. This is a real free trial offer. All at our expense and risk. Fill out and mail the coupon and get the Oliver for free trial. If you should wish further information before requesting a free trial, mark the coupon for the free books mentioned therein. Clip and mail the coupon now.

Canadian Price, $79

The OLIVER Typewriter Company

63A Oliver Typewriter Bldg., Chicago, Ill.

After July 1st, the price of the Oliver will be $65. As the present price of $55 has been widely advertised, we want to be perfectly fair and announce the price change in advance. If you act quickly, you can obtain the $100 Oliver for $55. Note that the coupon must be mailed before midnight, June 30th.

THE OLIVER TYPEWRITER COMPANY,
63A Oliver Typewriter Bldg., Chicago, Ill.

☐ Ship me a new Oliver No. 9 Typewriter for five days' free inspection. If I keep it I will pay $55 as follows: $3 at the end of trial period and then at the rate of $4 per month. The title to remain in you until fully paid for. If I make cash settlement at end of trial period I am to deduct ten per cent and remit to you $49.50.
If I decide not to keep it, I will ship it back at your expense at the end of five days.
My shipping point is.....

☐ Do not send a machine until I order it. Mail me your book—"The High Cost of Typewriters—The Reason and the Remedy," your de luxe catalog and further information.

Name.....

Street Address.....

City..... State.....

Occupation or Business.....

This coupon not valid unless mailed and postmarked before midnight, June 30, 1922

RADIO NEWS

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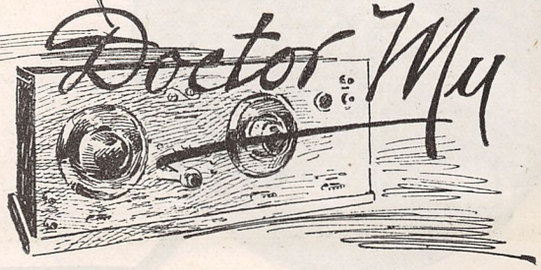
Publishers of Radio News and Science and Invention

H. GERNSBACK, President S. GERNSBACK, Treasurer R. W. DEMOTT, Secretary

The clouds pass—but the blue heavens abide:
and GREBE RADIO remains
the standard —



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GENUINE FADA RHEOSTATS

ARE BEING IMITATED IN MANY WAYS

The best of imitations are never as good as the originals.
Genuine FADA rheostats possess these features:

1. Heat resisting thermoplax base and knob.
2. Taper knob—fits the fingers.
3. Mounting screws do not show on front of panel.
4. Only genuine resistance wire used.
5. Properly designed contact brush that allows turn by turn adjustment and smooth movement.
6. Diameter over all is only 2⅛ in.
7. Careful inspection—we reject rheostats that are really better than many of those now sold for "just as good."
8. Quantity production of a standardized rheostat means that every rheostat is uniform and dependable.

It is necessary to use FADA rheostats to adjust the filament current of your vacuum tube whether you are using gas-content detector tubes, "hard" amplifier tubes or power tubes. The critical adjustment that can be obtained by using FADA rheostats will greatly increase the efficiency of your Radio set.

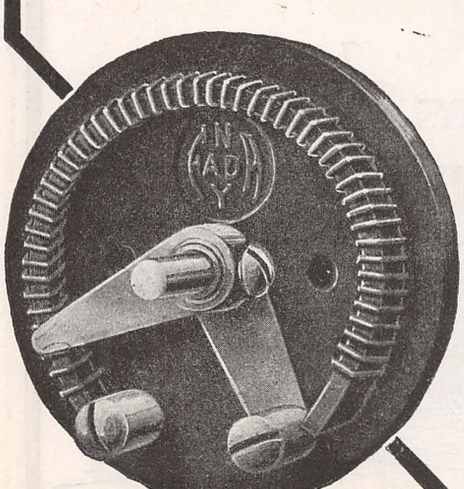
PURCHASE OF YOUR LOCAL DEALER AT PRICES MENTIONED BELOW

FRANK A. D. ANDREA

Manufacturer of the FADA line of Radio Equipment

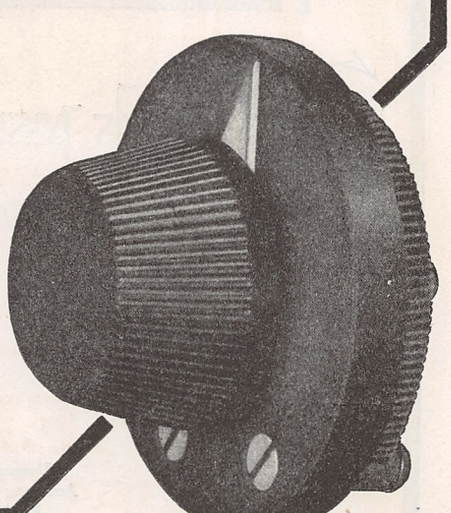
1882-A Jerome Avenue

NEW YORK CITY



No. 120-A Rheostat, $1.00
(6 ohms, 1½ amp.)

No. 121-A Rheostat, $1.35
(1½ ohms, 6 amp.)



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FROST RADIO
154 W. LAKE ST. CHICAGO. ILL.
Used Everywhere

Herbert H. Frost

NATIONAL FACTORY DISTRIBUTORS
TO THE ELECTRICAL RADIO JOBBER

FOR THE FOLLOWING

RADIO APPARATUS

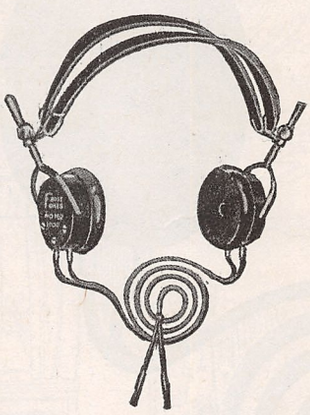
Unequaled results identify this Apparatus as highest grade workmanship and abundant value. Dealers: Inquire of your local Jobber.

CUNNINGHAM VACUUM TUBES

FOR

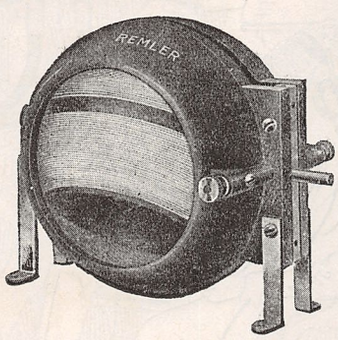
Home Radio Equipment

Meet every Amateur requirement.



FROST FONES

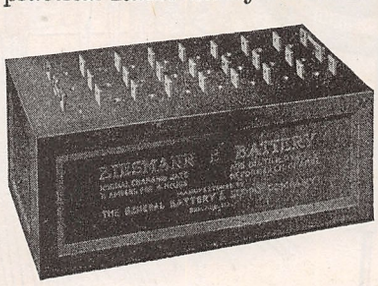
Ideal Receivers for use with Home Radio Sets. Combine maximum efficiency with permanent sensitiveness.



REMLER APPARATUS

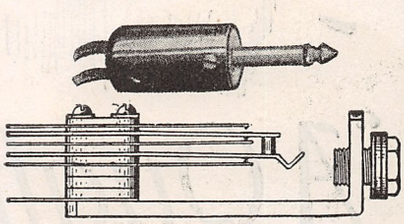
RADIATES QUALITY

Every Remler item is first studied and tested for its practical Radio utility before being marketed.



BIESMANN "B" BATTERY

Combination Detector and Amplifier Battery fully answering the "B" Battery Problem. Fully Guaranteed.



FROST IMPROVED PLUG AND JACKS

Specially designed for Radio Panel Work. Plugs interchangeable with other standard makes.

Prices on the above Radio Apparatus will remain at a standard level long after inferior goods have been purchased at cut prices and found to be unsatisfactory. Your trade knows and asks for Frost Radio Apparatus by name. Are you supplying them?

HERBERT H. FROST

154 W. Lake Street - - - CHICAGO, ILL.

FROST-FONES
FROST-FONES
FROST RADIO
Like Postage Stamps Used Everywhere
FROST FONES NO. 162 1000
"A Quality Achievement"
Herbert H. Frost
154 West Lake St.
CHICAGO

FROST-FONES FROST-FONES

FROST FONES

"A Quality Achievement"

The IDEAL RECEIVERS for use with Home Radio Set

Combining Maximum Efficiency with Permanent Sensitiveness

GUARANTEED BY THE NAME

PRICES ARE THE RESULT OF QUANTITY PRODUCTION

NO. 162 — FROST FONES 2000 OHM SET $5.00

NO. 163 — FROST FONES 3000 OHM SET $6.00

Deliveries Will Continue to Our Jobbers

Attractive Literature Mailed on Request

Herbert H. Frost 154 West Lake St. CHICAGO

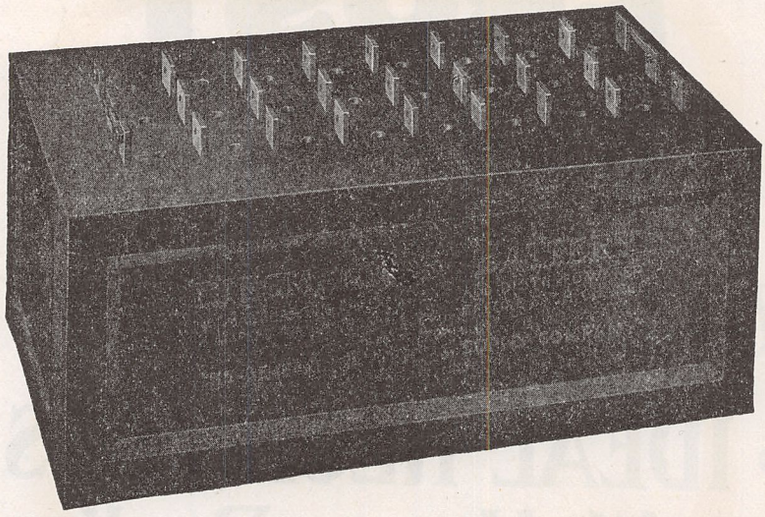
FROST-FONES FROST-FONES

THE CORRECT ANSWER To the "B" BATTERY PROBLEM

$14.00

50 VOLTS

2 VOLT STEPS



$14.00

EASILY CHARGED

LONG LIFE

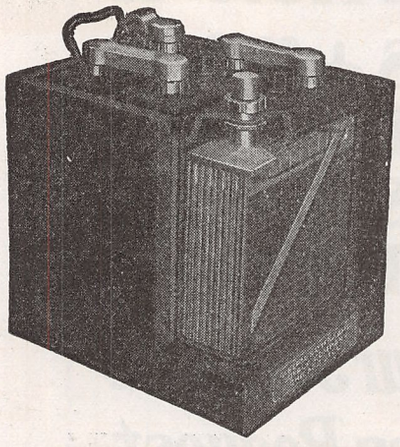
FROST RADIO
154 W. LAKE ST.
CHICAGO, ILL.

THE BIESMANN "B"

FULLY GUARANTEED

COMBINATION DETECTOR *and* AMPLIFIER BATTERY

24 cells, individually tapped, permitting use of any voltage from 2 to 50 volts in steps of two volts each. Provides a noiseless circuit for the receivers. The electrolyte is a semi-solid; cannot spill or leak. One piece cast "Rub-Tex" Indestructo case, of which the individual cells are a part. Highly polished and neat in appearance. Pasted type plates especially developed for Radio service. Can be re-charged at any Battery Service Station, or on any type of vibrating rectifier by using the circuit provided with the battery. Complete instructions with each battery. Contacts between cells easily accessible. Over-all dimensions; 9 inches long, 4½ inches wide, 4½ inches high.



The "BIG SIX" A-BATTERY

A FEW FACTS BRIEFLY STATED

Semi-solid electrolyte which cannot spill — No injurious sulphation — Plates will not buckle — Highest electrical efficiency and voltage maintenance — Quickly and easily recharged — Can stand idle indefinitely without injury — Superior physical properties — Hard wood case.

THE "BIG SIX" IS FULLY GUARANTEED AS TO LIFE, CAPACITY, ELECTRICAL EFFICIENCY, DESIGN AND WORKMANSHIP

6 volts— 40 Ampere Hours	$20.00
6 volts— 60 Ampere Hours	22.00
6 volts— 80 Ampere Hours	25.00
6 volts—100 Ampere Hours	28.00

Furnished in one piece cast "Rub-Tex" Indestructo case at an additional charge of $2.00 on each battery.

MANUFACTURED BY
General Battery and Supply Co.,
CHICAGO, ILLINOIS

JOBBERS
Write For Our Interesting Sales Proposition

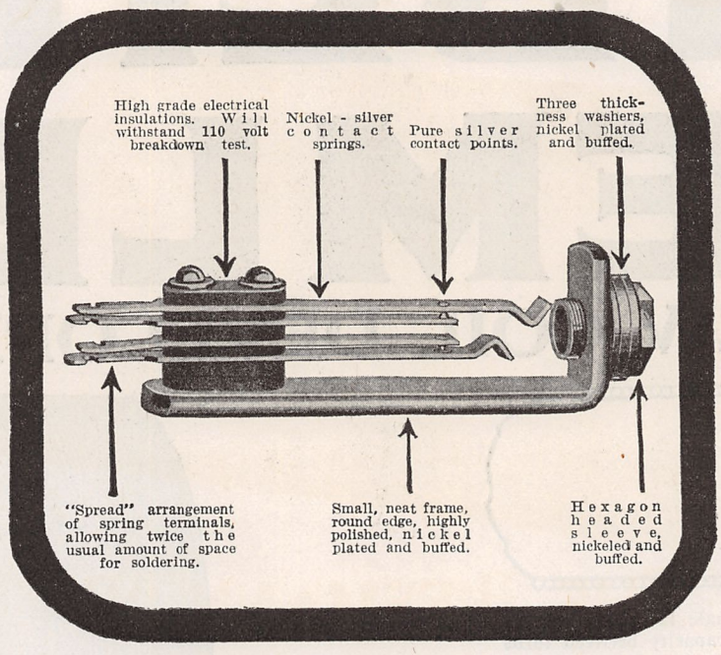
SOLE DISTRIBUTOR

HERBERT H. FROST, 154 West Lake St., CHICAGO, ILLINOIS

Frost-Radio

FROST RADIO 154 W. LAKE ST. CHICAGO, ILL.

Improved JACKS and PLUGS



Specially Designed for Radio Panel Work

Interchangeable With Other Standard Makes

The smallest, neatest, most perfectly finished jacks and plugs that have ever been offered to the Radio Trade. They have been specially designed for panel work and are of standardized construction so as to be interchangeable with other standard makes.

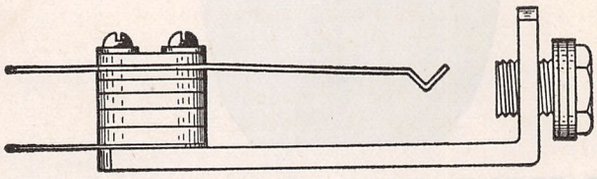
A particularly desirable and exclusive feature of the FROST-RADIO Jack is the "spread" arrangement of the spring terminals which allows twice the usual amount of space for soldering to the wiring. These terminals are heavily tinned.

Another striking feature is the nickel plated and highly buffed finish used throughout.

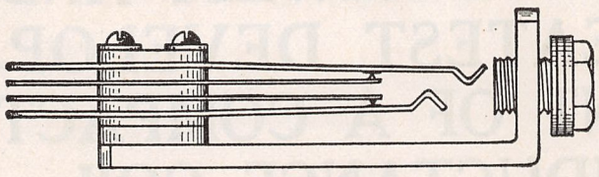
Sturdy construction, perfect spring adjustment, gripping contact of springs on tip and sleeve of plug.

Packed in individual containers.

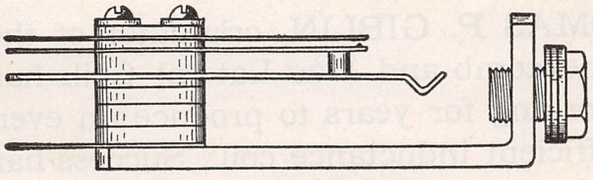
Two-color wall posters now ready for Dealer distribution.



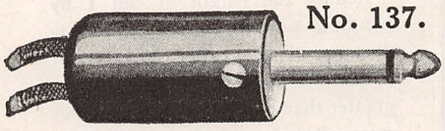
No. 133. Jack only, $.65



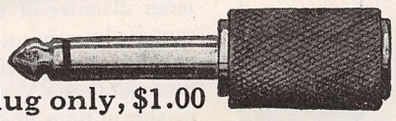
No. 131. Jack only, $.90



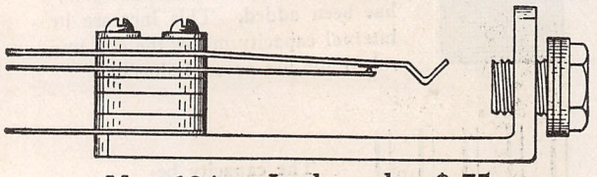
No. 135. Jack only, $1.00



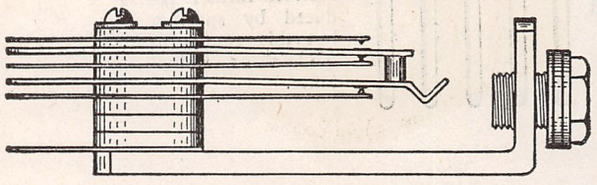
No. 137. Cord Tip Plug, $1.25



No. 132. Plug only, $1.00



No. 134. Jack only, $.75



No. 136. Jack only, $1.25

We Are Now in Quantity Production and Are Making Immediate Deliveries

HERBERT H. FROST

154 W. Lake Street
Chicago, Illinois

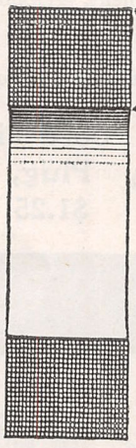
GIBLIN REMLER

A NEW COIL DEVELOPMENT

1

Assume that the above single layer coil consists of 1000 turns and that the capacity between turns is Y. Then 1000 Y is the total self capacity of this inductance.

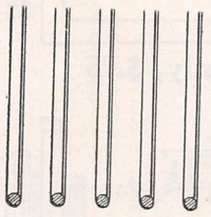
2



20 layers high
50 turns per layer
20 x 50 = 1000 turns

Reduce the length of coil 1 by winding a multi-layer compact inductance of 1000 turns (20 layers of 50 turns). The inductance will be greater than coil 1 due to the greater mean diameter of the turns. The capacity between turns is still Y, but an additional capacity between layers equal to 50 x Y (the mean of the number of turns in each two layers) has been added. This increase in internal capacity makes the coil unsuited for use as an inductance.

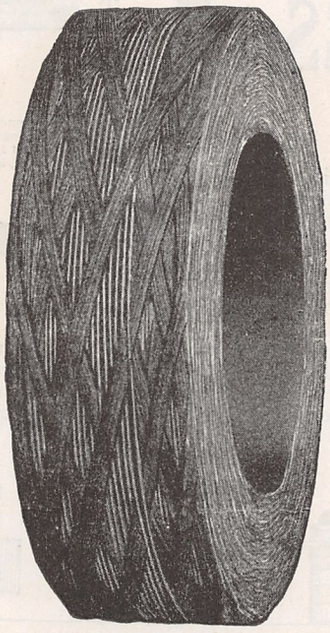
3



The capacity between layers and between turns is reduced by spacing, but this results in a loss of inductance.

4

Maximum inductance is obtained by winding the turns close together. This is the method used in the new Giblin-Remler Inductance, combined with a new method of separating the layers.



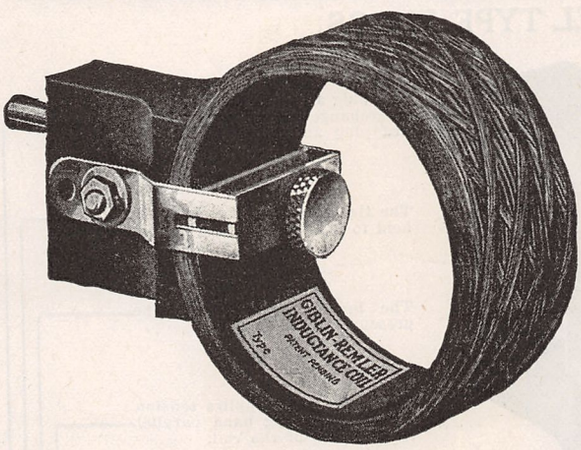
GIBLIN'S NEWEST AND GREATEST DEVELOPMENT OF A COMPACT INDUCTANCE COIL

THOMAS P. GIBLIN, originator of the Honeycomb and Duo-Lateral Coils has been working for years to produce an even more efficient inductance coil. Success has at last been achieved in the Giblin-Remler Inductance Coil.

REMLER RADIO MFG.
248 FIRST STREET, SAN FRANCISCO, CALIF.
E. T. CUNNINGHAM, General Manager

INDUCTANCE COILS

INTERCHANGEABLE WITH ALL COIL MOUNTINGS



Made by an entirely new process, Giblin-Remler Inductance Coils are infinitely more effective in operation and superior in workmanship to any coil on the market today. Its performance for concentrated inductance cannot be approached—it is equally efficient on all wave lengths. The self capacity of the new Giblin-Remler Inductance is 100% less than any previous compact inductance—this low self capacity gives selectivity and sharp tuning for a given coil. This is especially advantageous to the amateur who usually has an antenna of low capacity. The high frequency resistance is lower than any previous type.

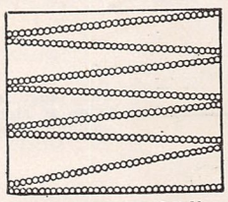
Giblin-Remler Inductance Coils are patentable—they are manufactured by patented machinery. You can purchase them from any authorized Remler Dealer.

Order Giblin-Remler Inductance Coils at once from your nearest dealer—or send direct to us. Learn how remarkably they will improve the performance of your set.

COMPANY

154 W. LAKE ST., CHICAGO, ILL.

Apparatus That Radiates Quality



5

In the new Giblin-Remler Coil *Cotton Yarn* is wound into the form of a lattice and simultaneously the wire is wound into the coil in parallel turns. The cotton yarn separates the layers of wire with cotton and *air cells.* The air cells are extremely important in reducing the high frequency resistance. This method of winding gives maximum copper space and insulation space in a given volume. The insulation between layers is greatest at the points of maximum potential difference.

Type and Number of Turns, Mounted	Price, Mounted	Type and Number of Turns, Unmounted	Price, Unmounted	Inductance in Millihenrys at 1000 cycles Accuracy ½%	Natural Wave Length in Meters, Accuracy ½%	Distributed Capacity, in micro-micro-farads, Accuracy 1%	Wave Length Range in Meters using Condenser of .001 max. and .00004 mfd. min.		High Frequency Resistance in Ohms at Wave Length Shown			
							Minimum	Maximum	200	500	1000	2000
RG 20M	1.50	RG 20U	.70	.030	39	14.3	63	334	.....	1.1	.....	.....
RG 25M	1.50	RG 25U	.70	.041	47	15.2	75	389	.....	1.5	.....	.....
RG 35M	1.50	RG 35U	.70	.083	87	25.4	128	550	.....	3.5	.....	.....
RG 50M	1.60	RG 50U	.80	.169	114	21.6	185	785	.....	8.8	4.4	.....
RG 75M	1.65	RG 75U	.85	.377	163	19.8	266	1170	.....	28.3	12.1	6.2
RG 100M	1.70	RG 100U	.90	.666	217	19.9	358	1550	.....	80.3	26.8	12.6
									1000	2000	5000	10000
RG 150M	1.75	RG 150U	.95	1.503	281	14.8	512	2320	69.8	23.8	7.1	.....
RG 200M	1.80	RG 200U	1.00	2.68	374	14.7	690	3110	.....	50.6	12.5	.....
RG 250M	1.90	RG 250U	1.10	4.20	424	12.1	860	3880	.....	87.5	19.9	.....
RG 300M	2.00	RG 300U	1.20	6.11	494	11.2	1030	4680	.....	141	29.3	13.8
RG 400M	2.10	RG 400U	1.30	11.04	618	9.7	1380	6300	.....	.....	54.6	22.3
RG 500M	2.30	RG 500U	1.50	17.50	747	9.0	1730	7900	.....	.....	93.1	34.9
									2000	5000	10000	20000
RG 600M	2.40	RG 600U	1.60	29.2	1024	10.1	2260	10250	.....	111	43.8	.....
RG 750M	2.65	RG 750U	1.85	39.0	1249	11.3	2660	11850	.....	.....	64	.....
RG1000M	3.40	RG1000U	2.50	71.6	1620	10.3	3570	16090	.....	.....	123	.....
RG1250M	3.80	RG1250U	2.90	108.0	1930	9.7	4380	19700	.....	.....	.....	.....
RG1500M	4.40	RG1500U	3.50	159.8	2300	9.3	5300	23800	.....	.....	.....	.....

These tests have been made by Robert F. Field of Cruft High Tension Electrical Laboratory, Harvard University, Cambridge, Mass.

THE NEW REMLER COIL MOUNTING

SIMPLE TO MOUNT. TIGHTENING BAND BUILT INTO MOUNTING. ELIMINATES FIBER BAND. MOLDED BAKELITE. INTERCHANGEABLY USED WITH REMLER COIL AND PANEL TYPE PLUGS.

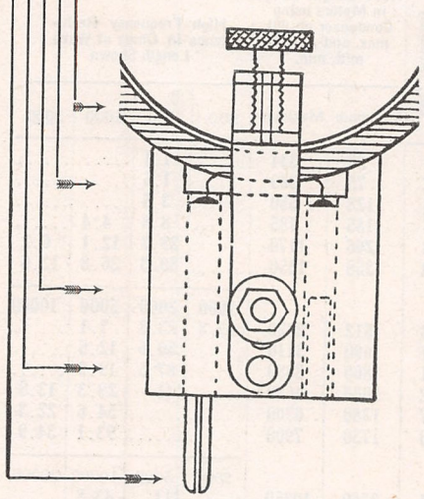
The plug terminal is slotted twice at right angles, insuring smooth, easy plugging.

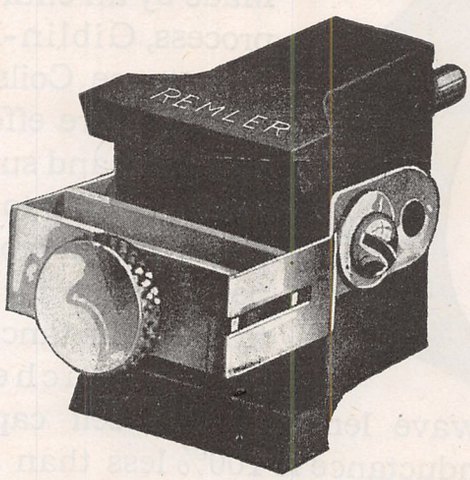
The tightening band is nickel plated. Three holes provide the necessary adjustment and prevent any slipping.

The plug is molded bakelite, buffed finish. The contour is shaped to the coil.

The solder terminals are countersunk, eliminating possible injury to coil winding.

The slot in the tightening band holds the pressure plates in alignment.





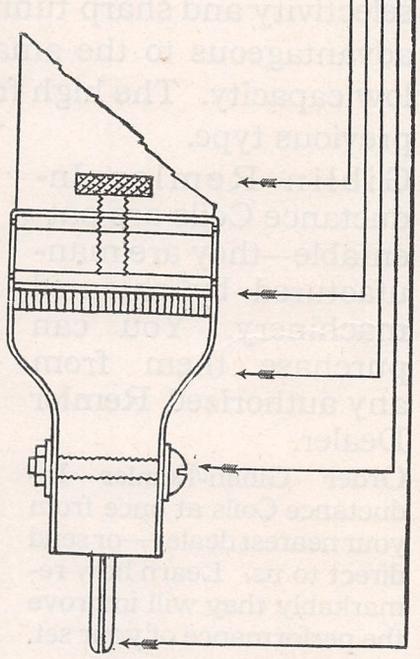
The plug and jack terminals are interchangeable with all standard plug and panel mountings.

The tightening band is securely held to the plug.

The lower plate absorbs the pressure on the coil.

The upper plate applies tension to the tightening band parallel to the sides of the coil.

A turn of the thumb screw separates the pressure plates and securely clamps the coil to the plug.



This new Remler Coil Mounting with its improved and original features is built especially for the new Giblin-Remler Coils. The plug can be used interchangeably with all Remler coil and panel type plugs.

The metal tightening band—an important Remler feature—eliminates the annoying fibre band and assures perfect tightness at all times. By simply turning the thumb screw the coil is rigidly fastened to the coil contour of the bakelite plug. There is no fibre band to become damp and stretch or to loosen the coil from its mounting.

Built complete by Remler, every operation is checked to insure a smooth working, simple operated plug—a plug with a Remler Guarantee.

PRICE

No. 48—20 to 750 turn coils.....70c
No. 49—1000 to 1500 turn coils.....80c

Amateurs:—Write for catalogue and name of nearest Remler dealer.

REMLER RADIO MFG. COMPANY

248 First St.,
San Francisco, Calif.

E. T. CUNNINGHAM,
General Manager

154 W. Lake St.,
Chicago, Ill.

14

RADIO FORMULAE AND DIAGRAMS

14

Schematic Wiring Diagrams, Measurements, and Tables for the Advanced Radio Student

All Formulae and Diagrams Printed on Heavy Paper in Black and Blue and contained in a two-color envelope 9 x 12 inches

CONTENTS

Measurement of Capacity of a Condenser (Substitution Method). Calibration of a Variable Condenser. Two Diagrams and Curve.....No. 1
Measurement of Inductance of a Coil or Circuit. Two Methods—Two Diagrams.....No. 2
Measurement of Distributed Capacity of an Inductance. Diagram and Curve.....No. 3
Measurement of Fundamental Wavelength of an Antenna. Three Methods. Three Diagrams.....No. 4
Measurement of Wavelength of Distance Transmitting Station. Two Methods. Calibration of a Receiving Set. Two Diagrams.....No. 5
Measurement of Effective Antenna Capacity. Two Methods. Two Diagrams.....No. 6
Measurement of Inductance of Antenna and a Third Method of Measuring Effective Capacity of Antenna. One Diagram.....No. 7
Measurement of Antenna Resistance. Substitution Method.....No. 8
Schematic Wiring Diagram of Regenerative Audion Receiving Set Suitable for Receiving High Power Undamped Wave Stations. Connections shown are those used in most Navy and Commercial Receivers...No. 50
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Table giving the value of LC (Product of Inductance and Capacity) for wavelengths from 300 to 20,000 meters. Inductance in Microhenries.....No. 100
Table same as above but with Inductance in centimeters.....No. 101

All 14 formulae and diagrams contained in heavy two-color printed envelope, size 9x12 inches.

PRICE 50c Prepaid

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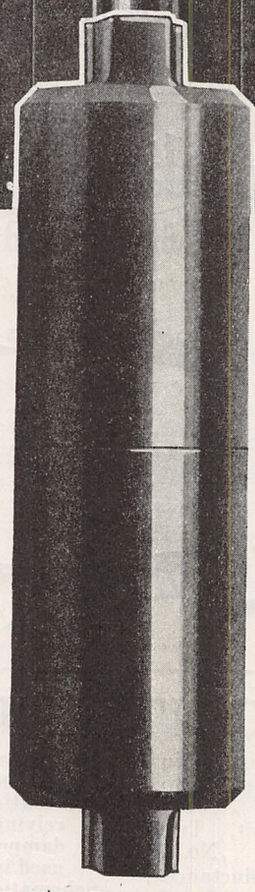
MYERS' CHOKE COIL



FOR AUDIO FREQUENCY AMPLIFICATION

PRICE $3.50

AMPLIFICATION WITHOUT DISTORTION

Build your amplifying set so you understand WORDS as well as MUSIC.

Make it sound like this—HELLO!
Not like this—HELLOWE!

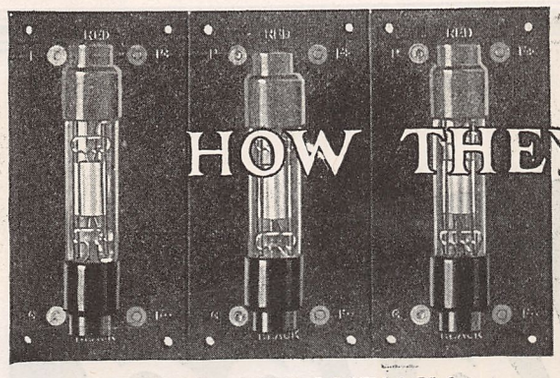
Use Myers' Choke Coil and get rid of that distortion which amplifying transformers produce due to the magnetic lag of the core.

Myers' amplifying coils are wound to balance the internal resistance of the Myers' Audion High Mu. When used with these tubes they give perfect speech amplification, no matter how many stages you build. They are designed to mount on the same base as the lamp.

Consult the drawing at the top of this page and see how compactly they mount with the lamp. *All wiring concealed* beneath bases and through panel between lamps and coils. Each piece of Myers' Equipment is designed with proper regard for each other piece.

RADIO AUDION COMPANY

90 Oakland Avenue **Jersey City, N. J.**



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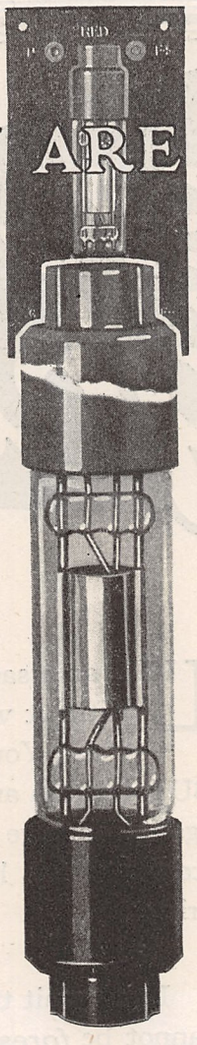

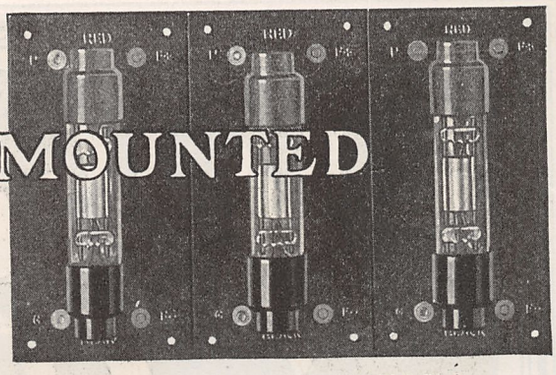

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HOW THEY ARE MOUNTED

MYERS' AUDION

HIGH MU

PRICE $5.00

FIVE TIMES THE VOLUME

The Latest Myers' Achievement

A tube that brings in the signals five times louder than other tubes

It oscillates uniformly from 2 to 300 volts on the plate and 4 volts in the filament circuit. It has no tube noises. It only consumes 0.8 amperes. It eliminates all Rheostat control. It is rugged and small in size, measuring only 3⅜ inches in length. In fact, it is the last word in audion tubes.

After November 7, 1922, the RAC-3 Audion will be available as a Detector and no longer limited for use in tandem with another device acting as a detector.

RADIO AUDION COMPANY

90 Oakland Avenue **Jersey City, N. J.**

This tube is not sold or purchased to be used as a detecter of wireless waves. Any use or sale of it for such use renders the vender or user liable to prosecution for infringement of patent. This tube is sold for use in tandem with another device acting as a detector for the purpose of amplifying either radio or audio frequency currents or as a generator of high frequency electrical oscillations

When Lightning

LIKE an assassin in the dark—lightning strikes without warning. It is no respecter of persons. You can make no agreement with it—BUT you can and *should* take proper precautions against damage and injury resulting from lightning storms which hot, sultry weather is certain to bring.

Don't wait till lightning strikes! Its fiery bolts cannot be *foreseen*—but the consequences can be *forestalled*.

A RADISCO Vacuum Lightning Arrester will guard your home and radio instruments—day and night. Its automatic vigilance assures absolute safety. RADISCO Lightning Arresters are leaders in the field. Their cost is small—and you can't afford to be without their protection. Don't take chances with inferior substitutes. Radisco Lightning Arresters are sold by leading radio dealers everywhere.

A Word To Dealers

These Lightning Arresters form a very small part of the entire RADISCO line. If you will look elsewhere in this paper you will find four advertisements on other RADISCO products, all of which will be in great demand during the summer months.

You can entrust your purchasing to the Radio Distributing Company, because the RADISCO organization is composed of experts obtained from all divisions of the radio field and the home of this well rounded RADISCO organization is in the heart of the radio activities of the world—within the Metropolitan district of New York.

Write for further information to the Radio Distributing Company, 8 West Park Street, Newark, N. J.

RADISCO

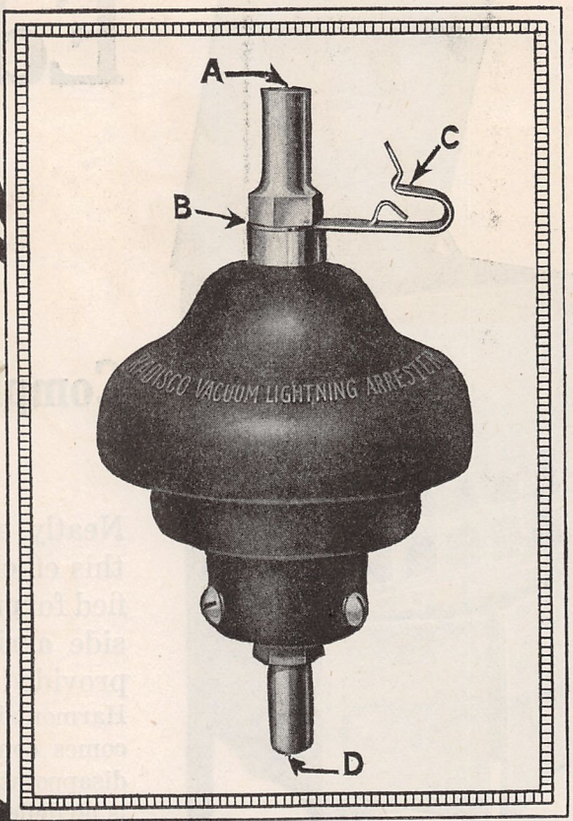
Radio Distributing Company
Newark - - - New Jersey

When you think of Radio—*think of*

RADISCO

"Your Assurance of Satisfactory Performance"

Strikes



RADISCO OUT-DOOR TYPE
Vacuum Lightning Arrester
$3

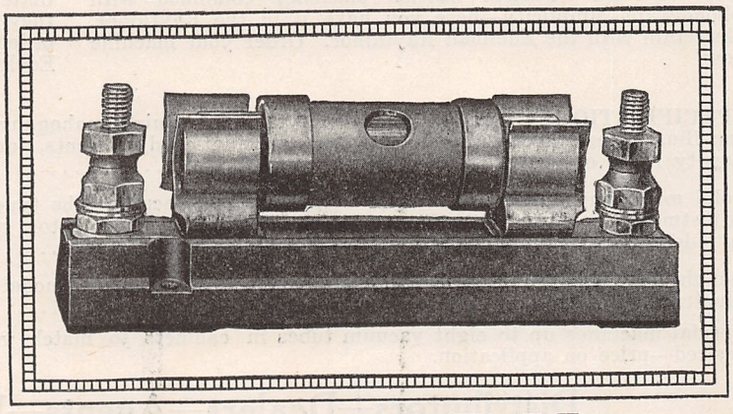
"IT SHALL NOT PASS"

RADISCO
OUT-DOOR TYPE
Vacuum Lightning Arrester

This type can be suspended directly from either end of the antenna, or from the lead-in insulator. The vacuum tube is enclosed in a porcelain moisture-proof casting.

The aerial wire can be soldered into Tube A; fastened under nut B. For hasty connection an automatic "Fahnstock" clip is provided and is shown at C. The wire to the ground can be soldered into the tube D or fastened under a hexagon nut at the upper end of this tube.

Price, $3.00



RADISCO
IN-DOOR TYPE
Lightning Arrester

This "lightning defier" is scientifically correct in every respect and has been approved by the National Board of Fire Underwriters. No switch to turn, nothing to forget; simply connect two wires to the arrester in accordance with instructions supplied and—the Radisco Vacuum lightning arrester does the rest automatically.

RADISCO IN-DOOR TYPE
Vacuum Lightning Arrester
$2.50

RADIO DISTRIBUTING CO.
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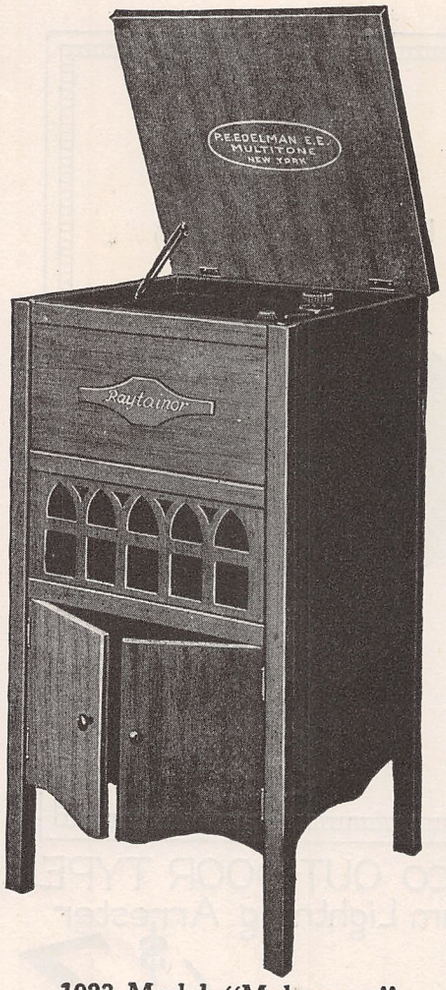
NEWARK, N. J.



1923 Model "Mahogany"

Edelman's Radio "Raytainor"

Complete Loud Speaking Receiving Set

1923 Models Now Ready

Neatly assembled in an original phonograph type cabinet, this efficient new radio receiving set comes to you in simplified form with only two adjustments. Its use requires no outside aerial nor so-called "loop," though binding posts are provided for those preferring same.

Harmonizing with real home surroundings, the Edelman Raytainor comes complete with all wood tone chamber, free from bother and disappointing rasping noises common to old style radio sets. There is no delicate regeneration so no adjusting skill is required. The outfit you hoped to get! Here it is, and at a reasonable price.

"Entertain with the *Raytainor*"

and enjoy the music without any bother

Invented and designed by Philip E. Edelman, E.E. (Mr. Edelman is the author of "Experimental Wireless Stations" and widely known as a competent radio engineer for more than a decade.) The new Raytainor comes to you ready for use. The experience is in the apparatus. You need no training to bring in the full radio entertainment for your friends with this machine. Central Station efficiency combined with phonograph simplicity—here you have it in the Raytainor. Entertain with the Edelman Raytainor. Order your machine now.

Enjoy the music and educational lectures daily without bother. No permission of landlord required with this machine. Full instructions accompany every instrument. Absolutely safe and free from lightning danger. Any bright child can install and operate the Edelman Raytainor. Radio with the bother left out. That is what the Raytainor means to you. Clear as a bell, without distortion, the Raytainor gives you full, loud volume with faithful reproduction of the original radio program. Sizes and styles to fit all purses. Immediate deliveries from reliable dealers in your locality, or they will order a machine for you for prompt delivery. Mail orders accepted only if your dealer refuses to order genuine Edelman apparatus for you. Send his name.

SPECIFICATIONS—Standard model Raytainor, genuine mahogany finish like top illustration, three vacuum tube type, automatic adjustments, for use within twenty miles of broadcasting station, only..... **$185.00**

Solid mahogany, finished like top illustration, four vacuum tube type, automatic adjustments for use with famous Edelman Radio Concentrator requiring no outside wires (minimum range up to thirty miles), only..... **$225.00**

Genuine mahogany or walnut, four vacuum tubes, console model like lower illustration, only..... **$375.00**

Special machines up to eight vacuum tubes in cabinets to match your furniture, any range desired—price on application.

1923A Console Model
"Mahogany or Walnut"

Distributors—Dealers—Agents—WIRE!

We are in quantity production and every "Raytainor" machine is absolutely guaranteed to work with standard Radio Corporation Tubes which we sell and recommend. Apply for territory or trade prices and enclose references showing that you are really entitled to trade quotations. Address now——

Philip E. Edelman, E. E., Mfgr.,
9 Church St., New York, N. Y.

Established 1910

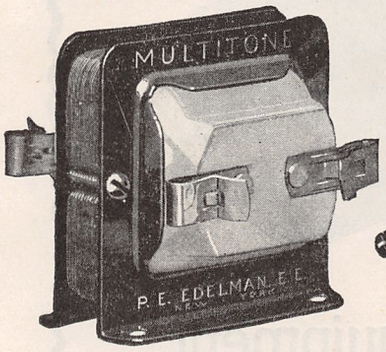
Edelman's "Multitone"

Quality Radio Sets and Parts—Guaranteed Satisfactory—Prompt Deliveries or Money Cheerfully Refunded.

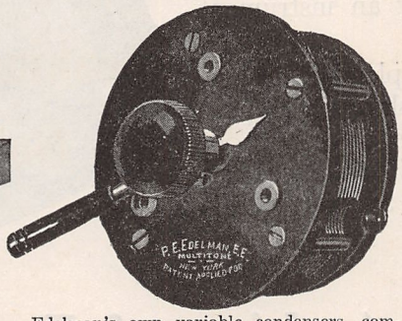
Like Edelman's Raytainor, Edelman's Multitone quality radio sets and parts are trade-mark registered, design patented, and fully protected by issued and pending and applied for patents. Licensed for experimental and amateur home use. Each item is made the best I know how, consistent with reasonable price, properly packed in complete package with instructions for use, and absolutely guaranteed to be as represented. Accept no substitutes. If your dealer won't supply genuine Edelman apparatus, order direct. The illustrations herewith are genuine photo-reproductions.

—*Philip E. Edelman.*

"Every Radio Man Knows Edelman is O.K."



Edelman's genuine silicon steel inter-stage amplifying transformer, properly designed so you can make your own amplifier—only..... **$5.50**



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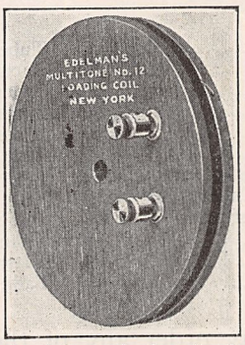

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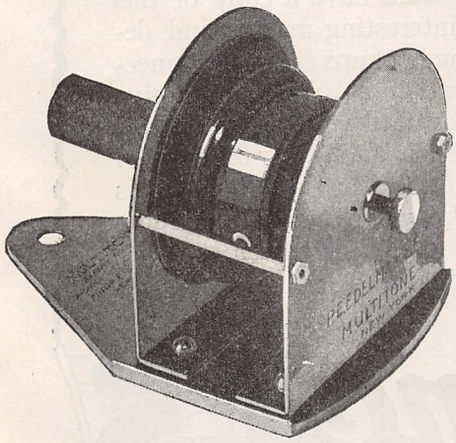

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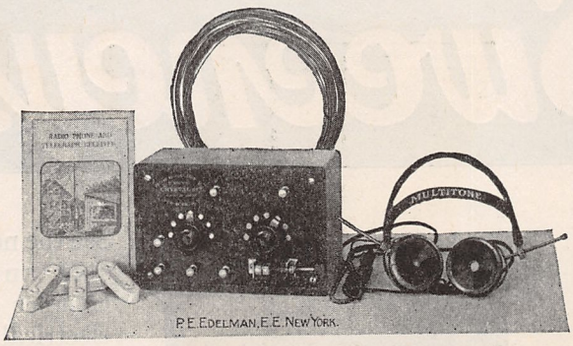

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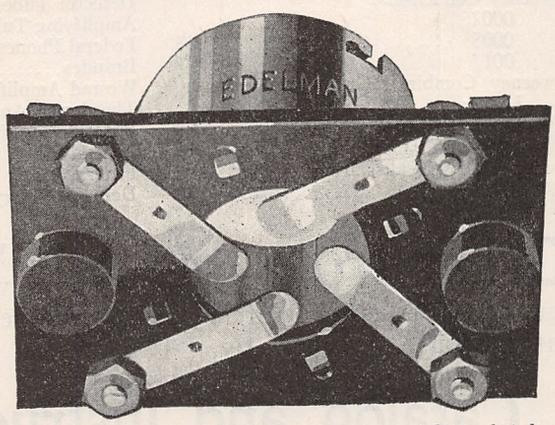

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for use to.....
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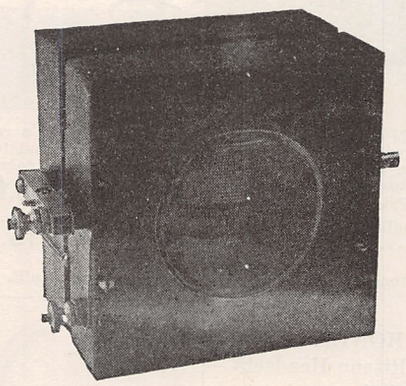

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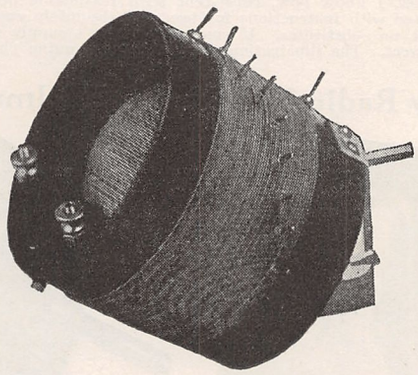

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RADIO NEWS

H. GERNSBACK—Editor
ROBERT E. LACAULT—Associate Editor

Vol. 4 JULY, 1922 No. 1

The Radio Business

IN our March, 1922, issue, we said as follows:

"The question which the writer is most often asked today is, how long will the boom last? When will the storm of prosperity blow over, leaving everyone prostrate with huge stocks on his hands?

"It is our opinion that the present conditions will last for at least another year and that the radio business will be a very healthy one for several years to come. There will probably be the usual summer slack—although much less pronounced—and then a great rush for the fall and winter. Indications are that within the next six months there will be enough apparatus to go around. Tremendous efforts are being made by manufacturers to meet the situation, and with all the new capital being poured into the business, we estimate that within six months at the most the supply will exceed the demand. In other words, everyone, unless he buys carefully, will be overstocked, and the usual hardships will follow.

"This not only holds true for the dealer who will find himself loaded with material on his shelves that he cannot move rapidly, but for the small manufacturer as well, who will have all his money tied up in merchandise for which the sale is not as brisk.

"We will then witness the next cycle: price cutting, when real competition will begin in earnest. This condition, however, is at least six months distant, and perhaps a little further. It is due to come, however, at any time, for some of the supplies."

The prediction is rapidly coming true, and as a matter of fact the eastern section of the country is already experiencing a phase of over-production. Millions upon millions of dollars have been poured into all sorts of radio enterprises, and several hundred new manufacturers have sprung up, all feverishly turning out goods to full capacity.

It is now possible to obtain merchandise almost everywhere and there is little actual shortage of any instrument at the present time. As we also predicted, the summer slack has already set in for some sections of the country, as for instance in the east, where the usual decline in the radio business is already apparent. To those who have been in the radio business for many years, this was foreseen. They know that in the summer time, the interest in radio matters is not as keen for the reason that many people are leaving the city, going on vacations. Also in those localities where evenings are uncomfortably warm, people do not care to stay home as much and work on their outfits, as during the cooler months.

All this was expected by those who knew, and only newcomers in the business who thought fortunes could be made almost overnight feel keenly disappointed. This is true mostly of the dealers who have little business at the present time, but not of the manufacturers who are still behind in filling their orders. If all this sounds pessimistic, we have no intention of its being so construed. We merely wish to point out to those newcomers that as far as the writer can remember—he himself having started in the radio business as far back as 1904—there was *always* the summer slack.

It is thus with many lines of business which are seasonal, and it will probably be always thus. Take for instance the phonograph business, which is always slack during the summer despite the heroic efforts of the dealers as well as manufacturers to change the trend of the public. So far, they have not succeeded and it is not likely that they ever will.

The most dangerous phase that the radio business is now confronted with is poor merchandise. It seems that every man in the country who has had a few thousand dollars lying loose has suddenly contracted the radio fever and has become a manufacturer somewhere, in an up-to-date loft, or in an attic. These people know little or nothing of radio matters, and as a rule take the word of some amateur that he has a world-beating invention that will revolutionize the radio business. Many such people are beginning to manufacture and many of them are turning out goods that are apt to take away all confidence of the public that is buying radio instruments.

There are at present a number of radio outfits on the market which violate every principle of sound radio engineering and each one of these outfits will kill a dozen sales of good instruments. When an innocent buyer, not at all versed in radio matters, buys one of these atrocities and promptly throws it into the nearest ash-can in disgust, he will not talk well of radio and his friends will believe him. It is this phase that is of tremendous importance at the present time. Not only are most of these goods designed incorrectly, but they are assembled in such a careless manner that even if the design were fair, it will hardly work.

There is still another important phase of which the new radio manufacturer knows absolutely nothing. The backbone of public radio is now, and probably will be for a long time, the radio amateur. Usually, when a man buys a radio outfit, he has some friend who knows something about radio, or who was a radio amateur at one time or another. It is well known by every radio dealer that a radio instrument, no matter what its description, is made or killed within a month of its appearance, by the radio amateur. If the radio amateurs—those who know—do not take to an instrument no matter how well designed, the manufacturer can make up his mind that it will not sell. If this statement is doubted, ask any radio dealer who has been in business for a number of years; but do not ask a new radio dealer, who has had no experience along these lines, because he would not know.

Before a manufacturer puts out a new instrument, and spends a great deal of money for patents and materials, he should make it his business to show a working model to a number of radio people who know the game. Then he should show it to reputable dealers of long standing experience. If he abides by their verdict, he will rarely make a mistake.

There is also to be considered the patent situation. Many circuits such as, for instance, the Armstrong regenerative circuit, nearly all crystal detectors and practically all vacuum tubes are patented articles. This phase should be carefully investigated by the new manufacturer because it will give him continuous trouble if his products infringe on these patents, as most of them doubtless do.

As to radio business in general, there is no question that there will be a very great mortality of dealers as well as manufacturers during this summer, due mainly to inexperience, and also to insufficient capitalization. Only those new concerns, whether manufacturers or dealers, having sufficient capital, will be able to survive, due to the fact that the radio business, as we have before mentioned, is always slack during the summer.

We are, however, emphatic in stating—and this may not be taken as a prophecy but as a positive fact—that from all indications the radio business, commencing this fall, will be even larger than that which we have just experienced. Let those concerns which are becoming discouraged take heart and try with all their resources to stay in business, even if they lose money, as many will do during the summer. Their reward will come after September 15. Those newcomers who say that radio is a fizzle and is petering out, are only voicing their ignorance in radio matters. The radio business is here to stay, and from present indications there will be over $100,000,000 worth of radio goods sold during the next radio year starting September 15.

H. GERNSBACK.

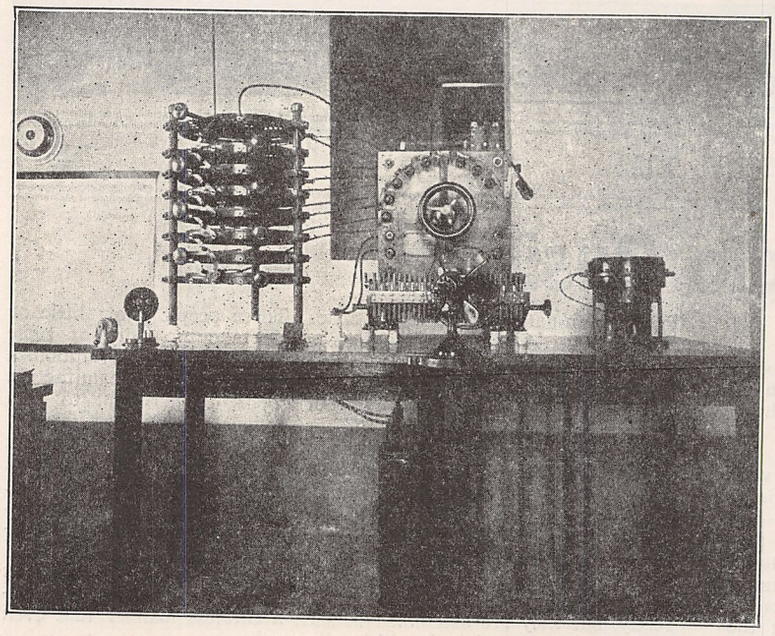
Important Notice

In accordance with the above editorial, the publishers have decided to open a free advice bureau for Radio manufacturers. Any manufacturer who is bringing out a new radio instrument or a new radio apparatus is invited to send in a sample of the actual product to the Editors. We will, beginning with the next issue, list articles which have been tested. Only such articles as our experts consider to be sound in all respects will be published, and no announcements will be made of apparatus which is not meritorious. Such apparatus will be returned to the makers with our advice as to how the devices can be bettered to make them marketable. This new departure does not only hold good for new manufacturers, but any manufacturer who desires can send in his apparatus for test, if he so elects.

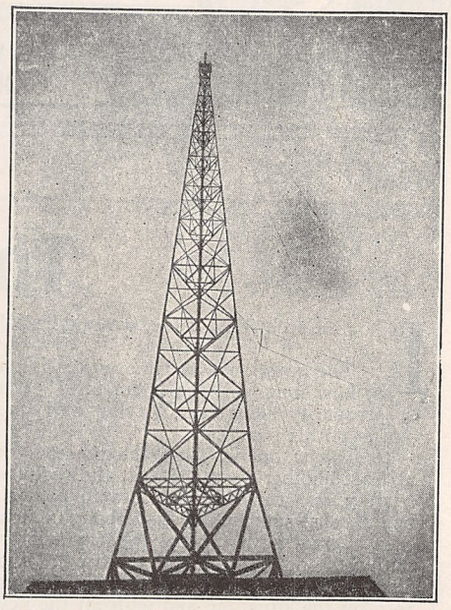
THE PUBLISHERS.

Chaparra "PWD" Coastal Radio Station

By U. MUNIZ*



On the left is the neatly installed transmitter with quenched gap and wave-changing panel. On the right is a view of the tower supporting the aerial.



IT is a remarkable achievement for a 2-k.w. spark station to obtain communication and reliable traffic exchange with points thousands of miles distant. As per latest data, this relies upon several details, such as the location, altitude, overall efficiency, etc., and so this low power, standard type transmitter at PWD has already received test telegrams and afterwards daily service with Nassau, Cape May, New York, to the north, and US, the Swan Island United Fruit's station, Venezuela Government stations and ships over 800 miles away in the Atlantic.

In the year 1917, in the Chaparra Sugar Mill, property of a former President of the Republic, there was installed a set constructed in composee garb, giving excellent short distance work, but lately the importance of the place was such as to make the Cuban Radio Department think of erecting something better at that end.

The engineer of the Department, Mr. J. L. Valladares, was sent in advance to study the location and better development of the official plans. At a side of the roadway to Chaparra Sugar Mill and two kilometers and a half from same, in a property about 4,000 square meters, were laid the first works under the personal supervision of the erecting engineer, Mr. Valladares, also designed by the Government for this important work.

Once the hard toil of installing, connecting and placing the transmitter and receiver in the eight-room concrete and brick one-story house was finished, the first commercial broadcast was given to the ether announcing to everyone the official establishment of this eastern wireless station on the north coast of Cuba.

Following details gladly submitted by Mr. Valladares we find in the first room a waiting room for the people depositing service with the station. At the other side, the chief operator's dispatch, in front of which are the transmitter, receiver, control boards, and telegraph (land line) table. Behind this is another salon containing the motor generator group, general power switchboard and storage battery service mains. The remaining rooms are living ones for the chief operator, his family and operators.

The transmitter is a wireless specialty 2 k.w. quenched spark one, modified by the constructor of the station. Instead of the three standard wave-lengths of 300, 600 and 952 supplied by the maker, there are 300, 378, 476, 600, 756, 952, 1200, 1512 and 1905 meters with the circuits accordingly modified. Dubilier mica condensers are used throughout, with three sets of spares; the high potential transformer delivers 11,300 volts in the secondary, and is duplicated, with a special switch for using either in case of breakdown.

The quenched gap is the standard type, with a ventilating fan, for the air blast supplied with the set was inefficient and very troublesome. There is also a switch for operating the quenched or the rotary gap, easily seen in one of the photographs. The second gap has a high pitch, but is used for short distance work only, as it is well known the coupling with this type of gap cannot be so close as with the quenched one, and the energy radiated by the antenna system is necessarily less.

Testing devices are used here; one of them is standing by the loading coils.

Coming to the receiving table, a standard Wireless Specialty 300 to 6,800 meters tuner with Bureau of Standards Detector and Marconi commercial two-step amplifier, with the "juice" coming from an Edison storage battery outside this room. Western Electric tubes and phones are employed therewith.

In this table are also located the changeover switch, the starting box and control rheostats for frequency and voltage regulation, as well as a telegraph sounder and line key connecting with the official telegraph system in such a way that the radio operator can dispatch when there is not much wireless work, the land work from and to official sources. Handy about this are lightning switches for disconnecting transmitter and receiver in thunder storms.

On the following is the land line operator's work. Two sounders and corresponding keys are for his use and daily communication with Chaparra Sugar Mill and the nearest telegraph office, Delicias.

Going to the outside, we pass the master power and storage battery room. A large control board can be seen there, and wires bringing power from Chaparra's mains at 220-v., 60-cycle, 3-phase current merge into conduit tubing and neat connections out of sight lead them to the 10-H.P. motor moving the 500 Cycle Crocker Wheeler alternator and exciting dynamo with two direct current windings, one for the generator field and the other to the charging panel of the storage battery set. This is an Edison 100-ampere hour type, six volts for the filaments of the receiving tubes and 50-volt smaller type for the plates of detector and amplifier bulbs.

Further on the outside, the large extension of the aerial wires comes

(*Continued on page* 96)

The Receiving Room Is Comfortable and So Arranged That All the Controls Are Within Reach of the Operator on Watch.

Cuban Correspondent for RADIO NEWS

Portraits Radiated Through the Ether

By Dr. ALFRED GRADENWITZ
Berlin Correspondent, Radio News

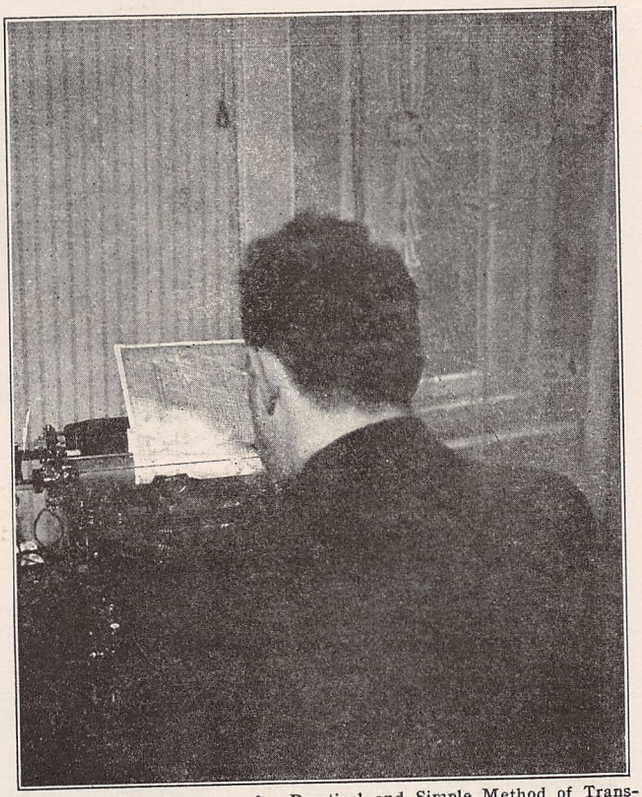
Portrait of the King of Italy Transmitted by Radio by Dr. Korn in Experiments Conducted at the Request of the Italian Government

THE story of many an achievement of modern science sounds more romantic than the wildest products of human fancy; reality often is more marvelous than boldest fiction. Let me tell you the tale of the portrait sent out into ether on the waves of electricity, picked up anywhere within the range of the sending outfit and reconstituted within a minimum of time.

Some days ago, I had the pleasure of meeting Dr. Arthur Korn, Professor of Physics at the Berlin Technical High School, who had just come back from Rome, where, on an invitation by the Italian Government, he had submitted his methods of Tele-Photography to severe, and most successful tests. He gave me an account of these tests, handing me at the same time some excellent telephotographic prints for reproduction in this magazine. The following is the substance of his report:

Prof. Korn's method for the wireless and cable transmission of photographs had, truth to say, already been worked out in principle in 1914, and the first practical tests between Europe and America were to have taken place in connection with the San Francisco World Fair. The construction of the experimental outfit to be used to this effect was delayed by the war. Though laboratory tests, as far back as in 1915-1917, gave excellent results, the first opportunity of making tests between remote stations was afforded some weeks ago, when from the Centocelle (near Rome) radio station, photographs were sent by wireless to ships on the high sea as well as to Massaua (Abyssinia, Red Sea); the presence of the King of Italy with the first transmissions lent additional solemnity to the inauguration of this method, which is now being used for wireless picture transmission between Rome and the United States.

Inasmuch as the receiver—apart from the usual wireless receiving outfit—only requires a special typewriter, no material difficulty had to be overcome at the receiving end. The sender, which is the most important and most interesting part of the plant, was installed in Rome by Dr. Korn himself and his assistant, the Italian engineer, Carazzolo. In the case of tele-photographic transmission to ships, an Italian marine officer would take the special typewriter with him on board the vessel where pictures were to be received. One picture was received on board the armored cruiser "Andrea Doria" off Spezia, another on a torpedo-destroyer cruising on the high sea. In connection with radio-telephotographic transmission from Rome to Massaua, the picture being sent (the King's portrait, shown here) was at the same time recorded on a checking typewriter in Rome; in order to make sure that the radiogram representing the picture had been received correctly at Massaua, this radiogram was sent back by wireless from Massaua. These tests actually showed the typewriter method to be admirably suitable for cable as well as for wireless transmission to any distance.



Dr. Arthur Korn, Inventor of a Practical and Simple Method of Transmitting Portraits by Radio or Other Telegraph Communication, Operating the Special Typewriter which Reproduces the Portrait

Though the method itself has been discussed at length in my article on the "Cabling of Photographs," published about two years ago in the ELECTRICAL EXPERIMENTER, it will be well to briefly recall the underlying principle as well as any alterations resulting from the substitution of radio for cable transmission:

At the sending station, there is installed a glass cylinder rotating around and advancing along its axis, on which the original picture —in the form of a translucid film—is wound. The light from a Nernst lamp (which is a very bright and constant illuminant) is, by a convenient lens system, concentrated on a small element of the picture; owing to the rotation and progression of the cylinder, the various picture elements will thus in succession come into the focus of the lighting system.

After penetrating through the photograph and the glass cylinder, the light will strike a selenium cell, traversed by the current of a constant battery. Inasmuch as this light is more or less intense, according to the variable graduations of successive picture elements, the electrical conductivity of the selenium cell will vary in proportion, and along with it the current intensity passing through the line. The sensitiveness of the arrangement is greatly increased by substituting a pair of selenium cells to a single cell.

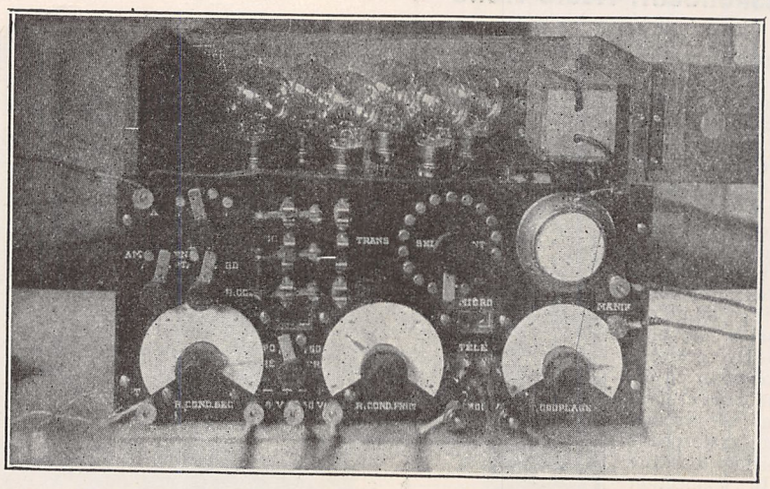
Whereas in the case of Korn's telephotographic method, these currents varying in intensity in accordance with the various shading of picture elements are, at the receiving station, by inverting the stages of this process, used to reconstitute the original picture, they, in the present case, serve to produce what the inventor terms a "provisional record," representing the sequence of picture elements in a perforated tape or in a series of letters, the various combinations of holes (or letters of the series) constituting a predetermined scale of shades. Let us suppose, for instance, that an "A" corresponds to the lightest shade and a "Z" to the darkest, the other letters corresponding to intermediate shadings. Prof. Korn has, for the first time, by means of a remarkably sensitive relay, thus succeeded in automatically converting the original photograph into a letter telegram. This can, independently of the tele-photographic outfit, be sent by radio to the receiving station, in order there to be reconverted into a picture. To this effect, a special typewriter is provided at the receiving end, where each type, in the place of the letter marked on the key-

(*Continued on page 98*)

This Portrait of Mrs. Arthur Korn, wife of the Inventor, Was the First to Be Transmitted by This System

The Development of Radio on Airplanes in France During and Since the War

By the Paris Correspondent of Radio News



A combination C. W. and phone transmitter and receiver used aboard airplanes. Three of the tubes are used for sending, one as a detector and two as amplifiers.

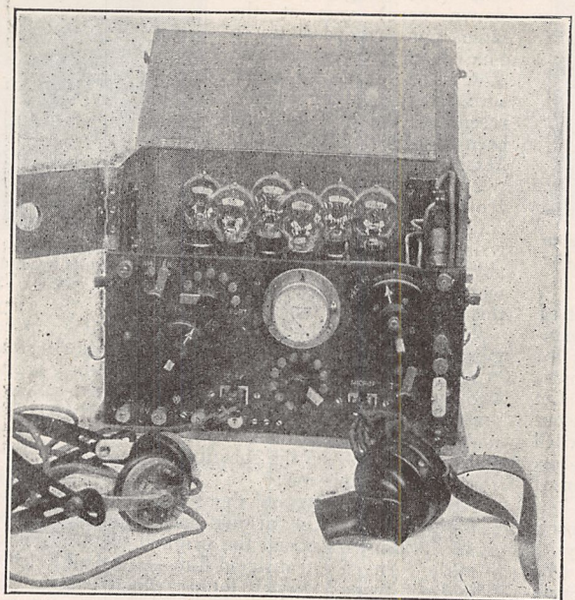
WE intend to describe in the present article the progress of airplane Radio, as developed during the war and the actual tendencies of Radio telegraphy and telephony on board air crafts for commercial purposes, the use of which becomes every day more necessary.

The first Radio apparatus for airplanes were designed in France at almost the same time as the Military airplane. As early as 1910, when the experiences of Wilbur Wright were not even two years old, the Military Air Force tried Radio communication between an aircraft and the ground. The type of apparatus which was used at first was somewhat similar to the ordinary land station used on trucks by the Signal Corps. That same type of apparatus was also installed on the dirigibles. This station was composed of an alternator driven by the engine, and an oscillating circuit connected to a step-up transformer. The spark was blown out by the wind produced by the propeller and the metallic parts of the aircrafts constituted the counterpoise.

The aerial, which was designed at the time, was used afterward during the war, and was composed of a copper cable at the end of which was attached a lead weight. The aerial wire could be wound on a hard rubber drum, so that any length of wire could be unwound for any particular wave-length. This provided a very fine adjustment and acted somewhat like a variometer in the aerial circuit. The connection from this aerial wire to the transmitting set was made by means of a highly insulated cable running through hard rubber conduits, preventing any short circuit with the counterpoise.

With this type of apparatus furnishing 500 or more watts, but weighing over 60 pounds, it was possible to reach ground stations 60 miles away. At this time no amplifier existed, and the receiving set made use exclusively of a crystal detector. The aerial was of the umbrella type supported by a 90-ft. mast. It was thought at the time to make it possible for the aviator to communicate directly with Headquarters while in flight over the enemy positions. The Military Aviation was considered at the time only as a means of observation, and the tests given to this system by both the Air Force and the Signal Corps, proved successful. However, it was later found that much more information was obtainable through the photographs taken by the aviators than by the short reports sent by Radio.

During the war it was found that the observation planes for both the Artillery and Infantry, as well as the bombing and hunting planes, needed Radio sets for various purposes. This necessitated the designing of special apparatus for each type of airplane, and was done by the Signal Corps.

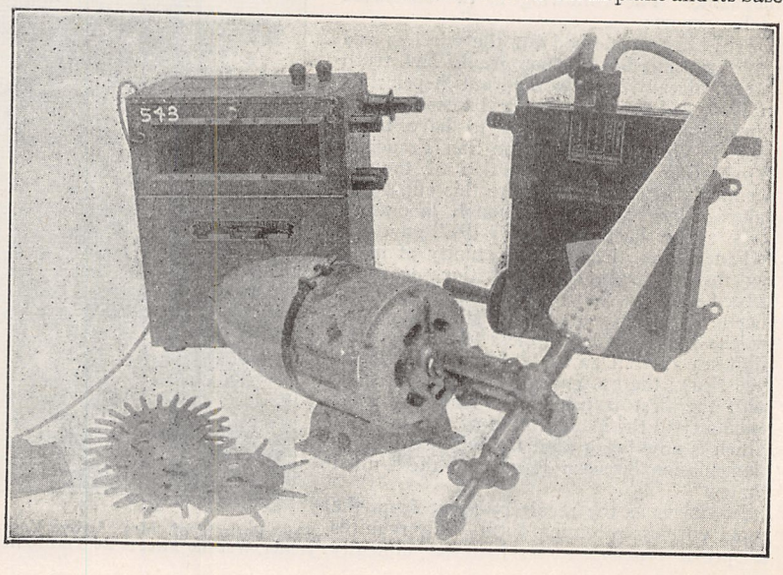


Another Type of Combination Phone Transmitter and Receiver, in Which the Same Tubes Are Used for Sending and Receiving.

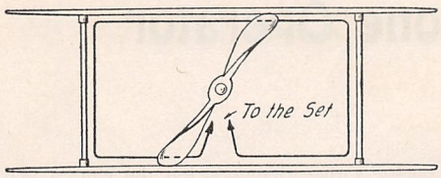
At the beginning of the war the airplanes, checking the fire from the Artillery over the enemy lines, used some colored rockets having special significations, which could be seen from the battery by means of field-glasses. Very soon this system proved quite inefficient and was replaced by Radio. In October, 1914, the first Radio-equipped airplanes were put in use and were found to be much more efficient than those using optical signals. Since the range to be covered was not very long, low-power transmitters were used. These consisted of a spark coil with separate interrupter and a spark gap directly connected in the aerial; the source of power was a storage battery. This kind of transmitter was used for over a year, as it was found possible to operate two and even three of these plain-aerial transmitters over one mile of front without interference. Different wavelengths and tones helped considerably in preventing jamming and efficient portable receivers permitted a very sharp tuning.

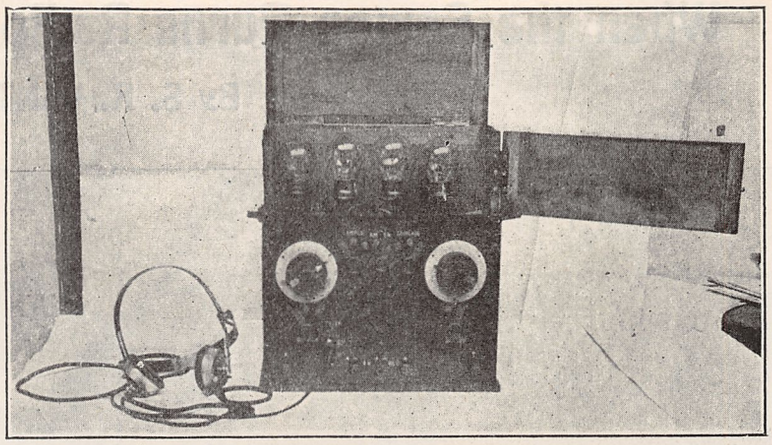
Although this arrangement was efficient, it became necessary in 1915 to improve both the selectivity and the range of the transmitters, as the number of airplanes operating close to each other and at greater distances was constantly growing. The first improvement in the sets was the removal of the storage battery, which was a source of trouble especially in various sections where recharging possibilities were poor. Instead, a small alternator operated by a propeller was mounted on one of the wings of the plane. Later, a special type of propeller replaced those previously used; these were automatic regulators and made the alternator run at the same speed, whether the airplane flew fast or slowly.

With these alternators furnishing about 125 watts of power an oscillating circuit which could be tuned sharply, was employed in conjunction with a synchronous spark gap mounted on the alternator shaft. By varying the number of teeth of the gap disc, various notes were produced which made possible the use of five or six airplanes over a mile of front, without interference for the receiving stations. When the big guns, having a very long range, were put in operation at the front, it was found best to equip the airplanes checking the shots with continuous wave transmitters. The Artillery batteries, which were mounted on trucks, were equipped with a similar set, which made possible constant communication between the airplane and its base.



A complete airplane spark transmitter composed of an oscillating circuit, a variometer and a 900-cycle alternator with automatic speed regulating propeller. Note the extra rotary gap discs.





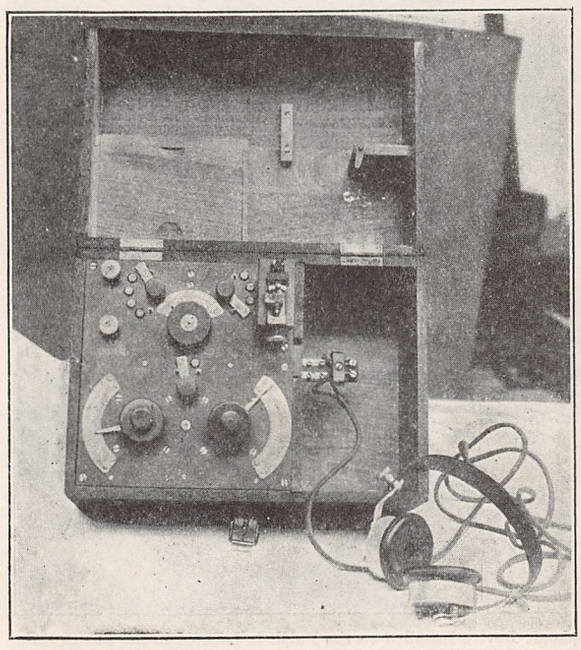
On the left the diagram shows how a fixed loop aerial is installed on a plane for the purpose of directing it. On the right is a compact receiver amplifier used on airplanes.

The reception on board the airplanes which in 1910 seemed impossible when there were no amplifiers, became possible, thanks to the vacuum tube. Fig. 6 shows one of the receiver-amplifiers combined, in which four tubes were used, one as a radio-frequency amplifier, one as a detector and two as audio-frequency amplifiers. One of the first apparatus in use on airplanes was a special device which made it possible for the observer to see the signals through a glass plate, over which the shadow of a mercury drop moved, reproducing the dots and dashes sent. This device had the advantage of not being influenced by the vibrations or noises of the engine, but it was soon abandoned on account of the difficulty of reading the signals with the eye. Later, special telephones mounted in the aviator's cap enabled him to read the signals in the ordinary manner without being interfered with too much by the noises of the engine.

When in 1918 groups of airplanes forming squadrons flying together were used for bombing or observation purposes, it was found necessary to equip all the planes with sending and receiving sets so that they could keep in constant touch with each other and with the airdromes. A special combination set was designed for this purpose as shown in Fig. 7. It may be used for continuous waves or telephony, and has a range of about 30 miles. This little transmitter was extensively used for communication between the airplanes, as it was found highly efficient for telephony over about eight miles.

To permit the aviators to find their exact positions when flying at night, or in a fog, radio compass stations were installed on the ground, which could ascertain the position of the airplane and send it by Radio, so that the aviator could locate his position on the map. However, this system did not prove accurate on account of the swiftness of the airplane which was far from the location given by the transmitting station when it was received. This led to the use of loop aerials on board the planes themselves. By turning the loop, the operator may at any instant locate the transmitting stations on the ground and ascertain the exact position by listening for the minimum of intensity in the signals from these stations.

The Radio Installation in a Modern Plane Carrying Passengers.



A Portable Receiver Designed by the Signal Corps of the French Army. It Has a Range of 100–600 Meters

Another system which was also successful for direction finding work on board airplanes consisted of a fixed loop wound between the two planes, as shown in Fig. 8. The two ends of the wire were connected to the receiving set and the airplane pilot could follow a route by listening to a certain station, the signals of which would fade, or become fainter as soon as the plane was turned at an angle. Although this system was not so accurate as the one mentioned previously, it was nevertheless sufficient to help an airplane pilot find his way toward a certain point without the manipulation of a rotating loop aerial.

Another problem which presented itself during the war was the use aboard the hunting planes of fixed aerials, which permitted the airplane to do acrobatic stunts without having the aerial wire hanging under and catching in the propeller or other parts when looping the loop. On account of the small size of these airplanes and the close proximity of the aerial and the counterpoise, a very poor radiation was obtained, which necessitated much research on the part of the engineers carrying on the tests. The solutions found to be the best consisted of the use of short aerials with the wires stretched in the shape of a "W," as shown in Fig. 10, or "V" shaped, with two or more wires stretched from the edge of the top wing to the rudder. The transmission with a loop aerial was also tried, but without great success.

The problem of radio control is also near its realization. In France, as well as in the United States, numerous experiments have been carried on to control an airplane in the air, without anybody being on board. It is possible, at the present time, to control an air craft with absolute security. The difficulty consists less in controlling the rudder and stabilizers than in preventing them from being accidentally operated by other signals. Thanks to a system of relays designed by Mr. Chauveau, it is possible to control one or more organs at the same time, with the possibility of preventing them from being accidentally operated. The description of this system is out of the scope of this article but we will endeavor to give to the readers of RADIO NEWS some interesting details about it in a future issue.

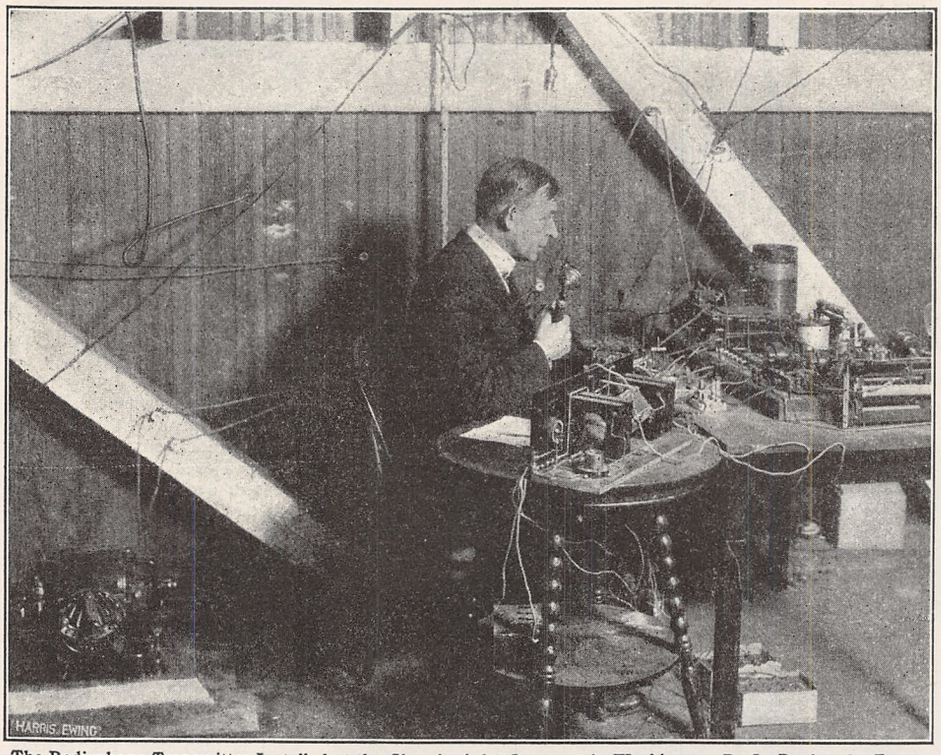
Since the war the problem of airplane radio telegraphy and telephony, has presented itself at different angles, as the commercial airplanes, which travel every day between the large European cities, need equipment of different design from that used for the military airplanes. In most of the big planes carrying passengers are found powerful C.W. and telephone transmitters, with loop aerials and special amplifiers for direction-finding work. A smaller transmitter, which can work even when the airplane is on the ground, constitutes the emergency set.

The standard type of telephone and C. W. transmitter used aboard the airplanes is supplied with current by a special machine coupled with a propeller which turns by the pressure of the wind when in flight. The transmitting set itself is constituted by big vacuum tubes supplied with about 1,000 volts on the plate, which give a range of about 200 miles. These sets enable the airplanes flying between Paris and London to keep in constant touch with both airdromes during a great part of the flight. The reception on board airplanes is somewhat more difficult on account of the noises which, until recently, it

(*Continued on page* 193)

When the Sexton Turns Radio-Telephone Operator

By S. R. WINTERS



The Radiophone Transmitter Installed at the Church of the Covenant in Washington, D. C., During the Tests Carried on to Determine the Effective Range.

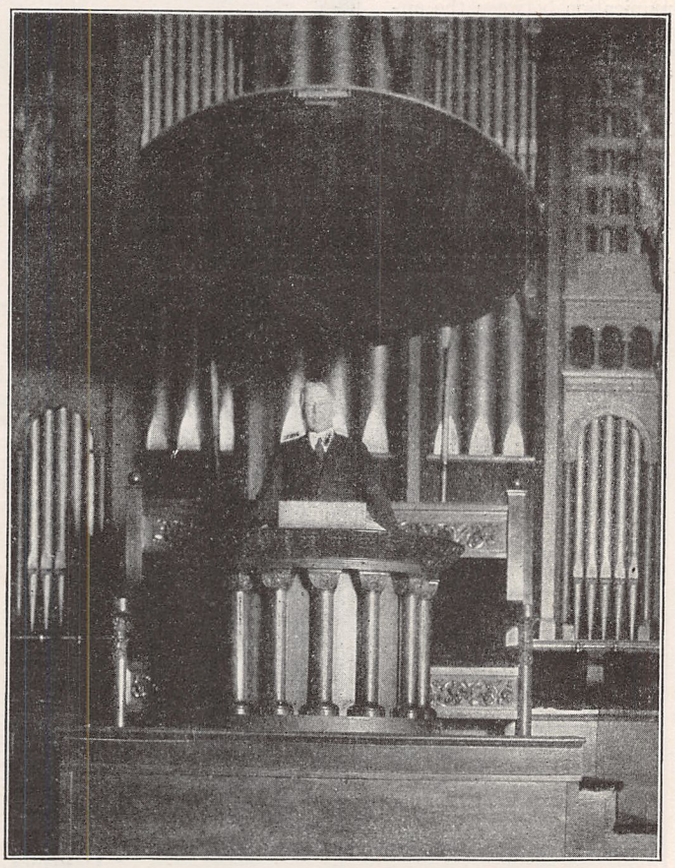
FROM time immemorial the duties of a sexton have varied little—tolling the church bell, sweeping the house of worship, building fires, and otherwise attending to the physical needs of an edifice dedicated to religious services. Innovations, however, may be expected in this century of remarkable scientific progress. Thus, it may occasion no startling surprise to know that the time-honored tasks of the sexton are subject to variation. Indeed, William E. Collier, official in charge of the Church of the Covenant, Washington, D. C., has made a departure in acting in the capacity of radio telephone operator in broadcasting the services of this Presbyterian church, located in the National Capital. He is probably the first sexton in the United States to familiarize himself with the intricacies of wireless and assume the responsibility of distributing the sermon and auxiliary services through ether to an invisible congregation for a radius of 350 miles.

The Church of the Covenant, located at a point in Washington where three streets, —Eighteenth, N, and Connecticut Avenue —touch elbows, is the first house of worship in the National Capital to enlarge its congregation by means of a radio telephone transmitting outfit. Reverend Doctor Charles Wood, pastor of this flock of the Presbyterian faith, introduced this departure recently. The three services on Sunday—at the hours 11, 3:30, and 8 o'clock—are flung into space on a wave-length of 360 meters, radiating its message for a distance of 350 miles. Not only are the deliverances of the pastor broadcasted, but the vocal and instrumental music of the choir may be heard by an invisible audience whose numbers and interest can merely be conjectured. Even the offertory hymn is radiated into space and the contributions offered by the visible audience may be made known to the widely separated and unseen congregation.

The pulpit of the Church of the Covenant is not subjected to the unseemly view of a radio telephone transmitting apparatus, as a photograph of the minister in the act of delivering a sermon indicates. An acousticon, an instrument barely discernible in the illustration, is located on the pulpit stand for the purpose of harnessing the voice vibrations of the preacher, whence they are conveyed by a wire to the loft of the church where the radio telephone transmitter proper is installed. Here, the sexton is seated and relays the church services to that invisible congregation within a radius of 350 miles of the National Capital. The primary source of the current for bearing vocal speech and music on electromagnetic waves is the city electric lighting system. This alternating flow of the popularly-designated mysterious fluid operates a motor, located in a corner to the left of the combination sexton and radio telephone operator, as portrayed by one of the photographs. This electric motor converts alternating "juice" into direct current, the sustaining power of the radio telephone transmitter.

The church belfry, whose single-minded purpose has been preserved through the ages, in this instance serves in a dual capacity. Other than housing the church bell, the square tower on this Presbyterian edifice lends itself to the formation of an antenna. Two wires projecting themselves from the tower form a V-shaped antenna. A specimen of the services of the Church of the Covenant, as observed on Sunday, April 23, 1922, consisted of: A sermon by Rev. Charles Wood, pastor, at 11 o'clock in the morning; at 3:30 o'clock in the afternoon, community instrumental and vocal musical service and an address by the regular minister on the subject, "Reasons For and Against Immortality;" at 8 o'clock in the evening, sermon by Rev. Charles Wood—"Messages from Books, Sacred and Secular"—"Concerning History: Samuel, Herodotus, Gibbon and Green." The evening choir is composed of 100 voices. Services during the week may include a discussion of radio telephony and radio telegraphy or presentation of other secular subjects. Recently, Dr. Louis Cohen, consulting electrical engineer of the Signal Corps, United States Army, and professor of electrical engineering at George Washington University, delivered an address subject to the broadcasting service of the Church of the Covenant.

The increasing recognition of the radio telephone as a medium for insuring an enlarged congregation for religious services renders opportune speculation as to its development in this direction. Is it too visionary to contemplate a centralization of the Scriptural lessons whereby a centrally-located pastor would exhort to a varied and remote audience—even to the far ends of the earth? Interesting speculation, to be sure. Certainly, radio communication is daily demonstrating its unbounded flexibility!



The Microphonic Device Installed on the Pulpit Is Located in the Box in Front of the Speaker and Invisible to the Audience. The Picture Shows Dr. Charles Wood Delivering a Sermon Which Is Broadcasted in a 350-Mile Radius.

Notes on Radio in China

By E. T. LOCKWOOD

"IT'S time for you to take to cover under the blankets," was what greeted the ears of a Shanghai amateur who was getting rather uppish with his 1 k.w. The operator of the local French station was giving him this gentle toning down for causing considerable interference on 600 meters. If a ham called up a Government station in the United States he might have his license taken away and a few other disagreeable things might happen. But this was Shanghai, China. Quite a difference!

SOMETHING MORE THAN LAUNDRIES IN CHINA

The average American Boy has the idea that, if he bored a hole straight through the earth he would hit a country which would be hot all the time and in which most of the people would be laundrymen with missionaries scattered here and there. As a matter of fact, it isn't squarely on the other side of the earth, it isn't hot all the time, and people do something more than wash clothes.

On the new Shipping Board steamers it takes only 20 days to go to China from San Francisco. The port of call is Shanghai, the most promising and largest Chinese port. The foreign settlement of this city is in every way modern, streets paved, high buildings, trolley cars, electrical appliances and the conveniences which are to be found in any American city. This is one of the most cosmopolitan cities of the world. There are about 15,000 white people here, of whom about 3,000 are Americans. The total population is a million and a half. Even Chinese cities are undergoing gradual modernization, and small cities now have electric lights, telegraphs, and telephones.

Professor Robertson (Standing with Transmitter) Lecturing Before 1,200 Students of the West Point of China, at Paotingfu, Chihli. Note the Receiver and Loud Speaker. The Radiophone Transmitter Panel Is Behind Professor Robertson. Note the Large Loop on the Left, Which Is Used for Telephone Transmission and Reception. The Other Station Was Placed Several Hundred Yards Away.

The climate of China varies, of course, with the latitude. In Shanghai it is hot in the summer, although very little worse than New York City. In winter it is a damp cold and there is usually a little snow. The climate has been compared with that of Charleston, South Carolina, with which city it is approximately in the same latitude.

The Custom's Permit, Which Was Necessary to Import Radio Apparatus. The Underlined (or Side-lined) Characters in the Fourth Row from the Right Say "Three Variable Condensers for Wireless Telegraphy." The Original Measures 16 by 25 Inches. Chinese Reads from Top to Bottom, from Right to Left.

GOVERNMENT RADIO

The Chinese Government has a few spark stations of moderate power, most of which carry on commercial business. They are efficient stations as far as they go, but at present, the Government radio facilities are very inadequate. They do not have in operation a single station capable of transmitting regularly over a thousand miles, although many are in contemplation.

JAPANESE ACTIVITIES

The best stations in China are those that the Japanese Government has established. There are several powerful stations at strategic points in China. The Japanese are constructing a large station near Peking for the Chinese Government at the present time.

NEW CHINESE-AMERICAN STATIONS

The Federal Telegraph Company of America has contracted with the Chinese Government for the erection of several high power radio stations, notably one at Shanghai, to be one of the largest in the world. This will be of great value to commercial interests in China because of the irregularity of the cables.

PEKING-TIENTSIN RADIOPHONE

Because of the difficulty of maintaining the regular (or irregular) long distance wire telephone, the China Electric Company, in coöperation with the Chinese Government has put in operation two stations to be used in lieu of the land line between Peking and Tientsin. Speech travels from house telephone in one city, via land wire, then radio, and then land wire again to the house telephone in the other city, a distance of over 70 miles. Both stations are easily heard in Shanghai, a distance of 650 miles. *This is the largest service of its kind in the world, and it's in China!*

NUMBERS FOR CHINESE CHARACTERS

Chinese writing is hieroglyphic and so the Chinese have had to compile a code book of characters and corresponding numbers. Thus each character is designated by a number in telegraphic communication. The standard Chinese dictionary contains something like 40,000 characters, but the ordinary number used does not exceed 5,000.

FRENCH RADIO SERVICES

The French have established a system of stations throughout China and Indo-China. They deserve much credit for the way in which they have for years rendered weather forecast service and time signals. The time signal is of the letter type, not beating off seconds, and is accurate to within a few seconds. The signals are relayed from the French observatory in Shanghai to the local station FFZ.

JAPANESE QRM

Much has been said about Japanese interference, intentional and otherwise. The main difficulty seems to be that the transmitters are directly coupled, of course, producing high decrement and a broad wave. The main difficulty with the Japanese themselves seems to be that they have an ingrained liking for repetition, which, with their cumbersome and lengthy alphabet, makes the whole Japanese Navy a nuisance to amateurs, as well as to professionals. Naval ships of various countries are allowed to use full power in the port of Shanghai.

(*Continued on page* 74)

Some New Radio Apparatus

An Automatic Filament Current Adjuster

Fig. 1.—Aspect of a Tungsten Filament Seen Through a Microscope.

Fig. 2.—A Ductile Wire Is Composed of Small Grains.

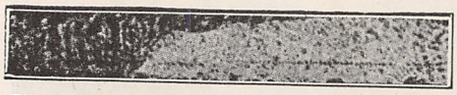


Fig. 3.—When Heated Slowly the Structure of the Wire Changes, as May Be Seen Above.

THE vacuum tube upkeep is the most expensive item in the modern radio receivers. Tubes are expensive, and their life is comparatively short. The latter is more true with the entrance of the general public into radio.

In spite of the vacuum tube trouble encountered in radio reception, little attempt has been made to find a remedy. The reason for this is the highly theoretical knowledge required to get to the bottom of the problem, and from the cause develop a remedy.

Look at the tungsten vacuum lamps burning in your home or office. Irrespective of their voltage or wattage, they all burn at the same temperature. This is not merely a coincidence. Every tungsten lamp is carefully designed to operate at that definite temperature. Why?

The life of any tungsten vacuum tube depends upon the life of the tungsten filament. Tungsten has the highest melting point of all metals, 3350 degrees centigrade. It can be obtained in the form of fine wire which may be bent and twisted like any other wire, or it may be as brittle as an eggshell. In vacuum tubes the ductile form is required.

If you look at a brittle tungsten wire through a high-power microscope, you will see something similar to the structure shown in Fig. 1. That is, the wire is composed of large blocks. Attempt to bend or vibrate the wire and it will immediately break at the boundary of the adjacent blocks.

Now replace the brittle wire by a ductile wire. It appears as shown in Fig. 2. A ductile filament is composed of small grains.

What makes tungsten brittle? Take the tungsten filament shown in Fig. 2. Heat it up slowly by gradually increasing the current, as done with the ordinary wire wound rheostat. Place it under the microscope and it will appear as in Fig. 3. Bend it—it breaks. You have changed the ductile tungsten filament to a fragile and brittle structure. The structure in Fig. 1 was obtained by burning the filament several hundred degrees below its proper operating temperature.

Therefore, contrary to popular conception, the vacuum tube should be flashed to its proper temperature as done in our ordinary incandescent lamps. This is a fundamental principle. Similarly operating the tube below its proper operating temperature tremendously decreases the life of the tube.

Now let us discuss the question of over voltage—operating the tube above its proper temperature. In this case two things may occur.

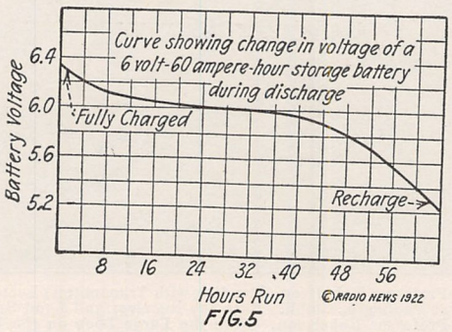


FIG. 5

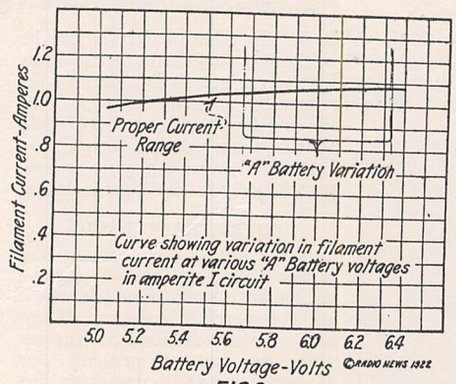


FIG. 6

Fig. 5 Is the Discharge Curve of a Filament Battery and Fig. 6 the Normal Current Regulation Through the Filament of the Tubes.

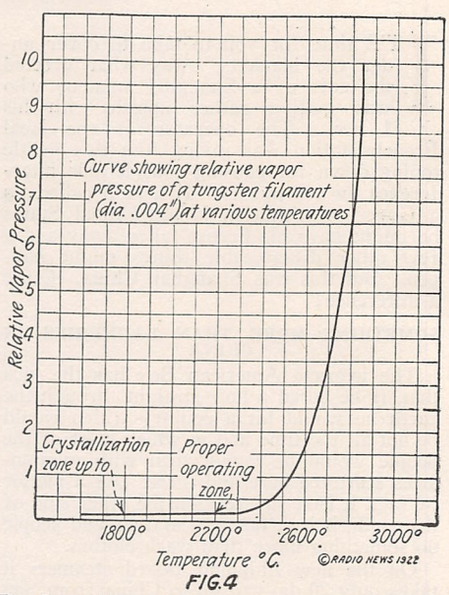


FIG. 4

This Curve Shows the Proper Temperature at Which a Filament Should Burn to Last the Maximum Length of Time.

1. If sufficiently overloaded, the filament is actually melted.

2. If operated only a few hundred degrees above its proper temperature, the filament rapidly vaporizes. Its diameter is decreased and its life is greatly shortened. The universally observed increase in the resistance of the tube follows.

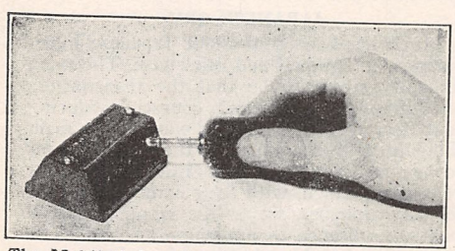
Now to explain how easily one can increase the temperature of the tube several hundred degrees. Turn the knob in the ordinary rheostat half way from its zero position. The tube filament has a red glow. From this point you will observe rapid increases in temperature, with a slight turn of the rheostat knob. By one-eighth turn the temperature is increased from approximately 800 degrees centigrade to 2200 degrees centigrade. Above 2200 degrees centigrade the temperature increases even more rapidly. Overloading the tube with the ordinary rheostat cannot be prevented without the use of meters.

Fig. 4 is a summary of the whole situation. Heating the filament below 1800 degrees centigrade crystallizes it and makes it brittle. Above 2200 degrees centigrade the filament is rapidly vaporized. The proper operating zone

(*Continued on page* 124)

Two New Radio Essentials

THOSE who use radio receiving outfits know how troublesome and unsatisfactory it is to pass a single pair of phones about, so that more than one person can listen in. If two sets of phones are available with only one jack on the receiver, they can be placed in the circuit only after much trouble and inconvenience. This problem has brought about the need of a "Twin Adapter" which will allow two phone connections or a phone and a loud speaker connection to be made with a single jack. To fill this need, the Pacent "Twin Adapter" has been brought forth, and with it one jack can be made to serve the purpose of two.



The Multijack Is a Practical Unit in Which Three Plugs May Be Inserted so That Several Pairs of Phones May Be Used at the Same Time.

$500 in Prizes in this Issue

RADIO NEWS now gives monthly prizes to readers. In this issue will be found prizes totaling close to $600. Look for these prizes in the following departments: "With the Amateur", page 42; "Wrinkle Prize Contest", page 61; "Special $375 Pocket Radiophone Prize Contest", page 64.

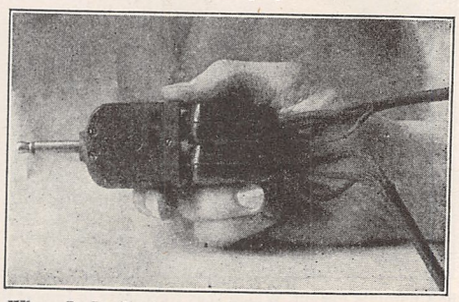
Prizes for "Amateur Stations" and "Radio Wrinkles" are given every month; these are the regular prize contests.

Watch for our next issue for new special prize contest, in which everyone, even a layman, can join.

Note also that RADIO NEWS pays highest prices for Radio articles and photographs. From one cent to three cents per word will be paid by the publishers for articles, all depending upon the subjects.

Thus the receiver can be tuned with the phones, and the loud speaker can be plugged in. The "Twin Adapter" will also be found very serviceable when making rapid connections and changes in C. W. work. It is provided with heavy phosphor bronze spring connections and is finished in polished brass and a velvety black composition.

(*Continued on page* 194)



When It Is Desired to Connect Two Instruments Through a Single Jack, This Twin Adapter Will Solve the Problem.

A Compact New Inductance Coil

By THOMAS P. GIBLIN

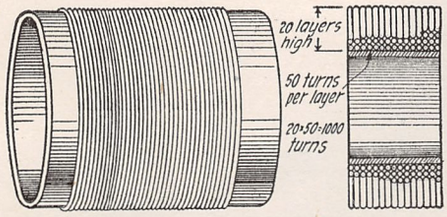


Fig. 1

Fig. 2

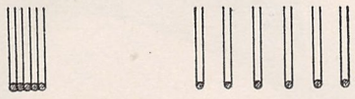


Fig. 3-A

Fig. 3-B

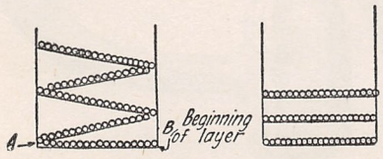
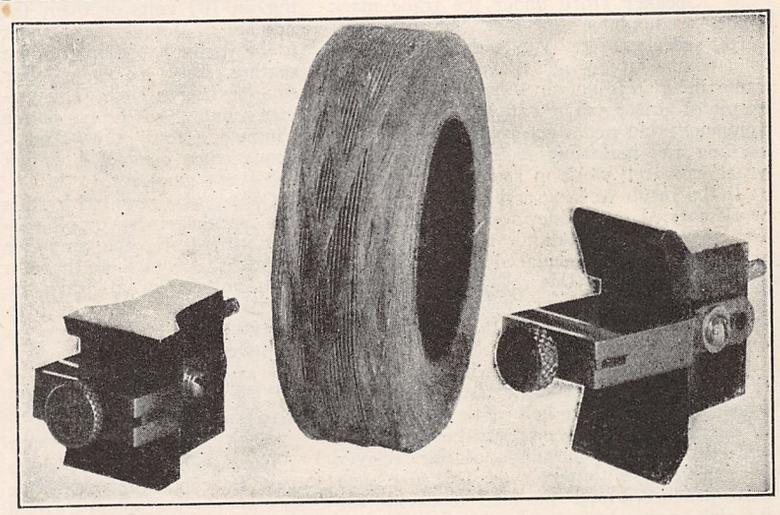


Fig. 4



This new type of inductance coil is wound in parallel turns, but the layers are separated by cotton yarn wound in honeycomb style. The mountings are also of an original design as the coil can be easily removed and replaced by another coil, the same mountings being used for several sizes of coils.

IN the old days of not so long ago we wound coils several feet in length to receive on long waves. There have been several attempts made to reduce the size of these coils and still obtain the necessary amount of inductance, without, at the same time, increasing the distributed capacity of the coil. The most successful of these attempts was the design of coil known as the honeycomb coil. From this was developed the duo-lateral coil.

The most recent development is the type of coil illustrated on this page. It is of an entirely new design with an air space between turns.

If the tube, Fig. 1, contains 1,000 turns of wire wound in one long layer, the inductance equals X, the capacity between turns equals Y, then $1{,}000Y$ equals the total self capacity.

Let us put this same inductance into multi-layer form, see Fig. 2.

Then inductance will be about the same only greater in this case, since each layer of wire is becoming larger in diameter. The capacity between turns is still Y, but between layers it equals $50 \times Y$ or the mean of the number of turns in each two layers. This capacity becomes great for the total number of turns and layers, and thus makes this type of coil of no value.

This capacity between layers can be overcome to a great extent by spacing the layers, but this must not be done at the sacrifice of inductance or resistance.

In my honeycomb and duo-lateral, I wound the turns with a space between each, so as to get space or air cells between layers, but this space kills inductance, see Fig. 3.

In the honeycomb and duo-lateral, you cannot get the spacing between layers if you wind the turns close together and you must have this spacing between layers to reduce capacity in multi-layer winding.

In the new coil we wind *cotton yarn* into the form of a lattice containing air cells, as the wire is wound in a honeycomb coil, but while this yarn is being wound in this way, the wire is going into the coil in parallel turns, as in spool winding, close together, side by side, the cotton yarn performing the "stunt" of separating the layers of wire with cotton and *air cells*. These air cells are very necessary in order to keep down the high frequency resistance. One other important feature is that, as the potential between the layers increases, so does the spacing, thus giving maximum copper space and maximum insulation space.

The method shown in Fig. 4 gives maximum copper space and insulation space in a given volume. If wound as in Fig. 5, you sacrifice copper space for insulation space.

The Fig. 4 method keeps down natural period because it takes less linear feet of wire also since the self capacity of the coil (which is 200 per cent. less than in honeycomb or duo-lateral) is reduced.

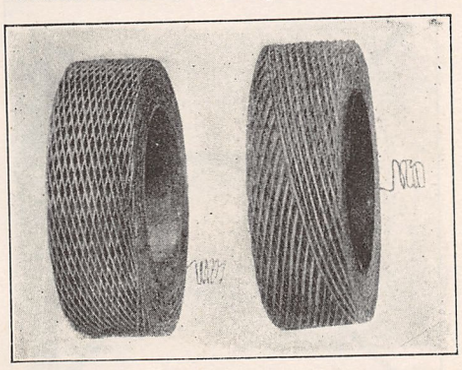
Thus, honeycomb coil minus inductance of 17.6 M. Henries Dis. Cap. equals 23 M. M. Farads

New coil minus inductance of 18.8 M. Henries Dis. Cap. equals 8.8 M. M. Farads.

This low natural period gives greater turning range for a given coil. The low self capacity gives selectivity and sharp tuning for a given coil, which capacity should be low, especially so with the amateur who generally has an antenna of low capacity.

Now as to the high frequency resistance, this, of course, depends upon the kind of wire, that is, Litz or solid conductor. It also depends upon the air cells in the coil, as air is better for the skin effect which exists in a conductor subject to radio frequency.

As you may see, a coil which, with its remarkable characteristics cannot be surpassed for a concentrated inductance, is equally efficient on all wave-lengths. This cannot be wound by hand as is the case with the honeycomb and duo-lateral coils.



The Honeycomb and Duo-Lateral Types of Inductances Concentrate in a Small Space a Large Amount of Inductance. Note the Different Methods of Winding

L_0	1,000 cycle inductance in millihenries	Accuracy ½ percent.
λ_f	Natural wave-length, in meters	Accuracy ½ percent.
R	High frequency resistance, in ohms, at 500, 1,000, 2,000, 5,000, 10,000 meters	Accuracy 1 percent.
	The quantities calculated were	
C_f	Distributed capacity, in micro-micro-farads calculated from L_0 and λ_f	Accuracy 1 percent.
λ_{min}	Wave-length range, in meters, using a condenser of maximum and minimum capacity of .001 and .00004 uf respectively,	
λ_{max}	and distributed capacity C_f, and 1,000 cycle inductance L_0	Accuracy 2 percent.

GIBLIN-REMLER COILS SOLID WIRE

	Turn	L_0	λ_f	C_f	λ_{min}	λ_{max}	H. F. Resistance			
		mh.	m	uuf	m.	m.	200	500	1,000	2,000
20	20	.030	39	14.3	63	334		1.1		
25	25	.041	47	15.2	75	389		1.5		
35	35	.083	87	25.4	128	550		3.5		
50	50	.169	114	21.6	185	785		8.8	4.4	
75	75	.377	163	19.8	266	1,170		28.3	12.1	6.2
100	100	.666	217	19.9	358	1,550		80.3	26.8	12.6
							1,000	2,000	5,000	10,000
150	150	1.503	281	14.8	512	2,320	69.8	23.8	7.1	
200	200	2.68	374	14.7	690	3,110		50.6	12.5	
250	250	4.20	424	12.1	860	3,880		87.5	19.9	
300	300	6.11	494	11.2	1,030	4,680		141	29.3	13.8
400	400	11.04	618	9.7	1,380	6,300			54.6	22.3
500	500	17.50	747	9.0	1,730	7,900			93.1	34.9
							2,000	5,000	10,000	20,000
600	600	29.2	1,024	10.1	2,260	10,250		111	43.8	
750	750	39.0	1,249	11.3	2,660	11,850			64.0	
1,000	1,000	71.6	1,620	10.3	3,570	16,000			123	
1,250	1,250	108.0	1,930	9.7	4,380	19,700				
1,500	1,500	159.8	2,300	9.3	5,300	23,800				

H. F. Resistance is in ohms, at the different wave-lengths given in meters.

A New Loud Talker

THERE has recently been produced and placed on the market a Loud Speaker Horn under the trade mark name "Audiophone" for receiving radio concerts, speeches, etc. While the Audiophone is a comparatively new development in the radio field, it is not an experiment, but the result of thirty years' experience in the development and manufacture of precision recording and indicating instruments, and six years' research work in sound reproduction. It is the result of long and careful research work carried out to develop a loud speaker for use with new talking moving pictures, which are soon to be placed before the public. The result of this research produced a loud speaker which gives a large volume of amplified sound, and yet faithfully reproduces the original.

The Audiophone, as shown in the illustration, is of a compact and artistic design finished in bronze. The bell of the horn is 15" in diameter. The design of the bell, neck and electrical characteristics of the receiver box, together with materials used, are such as to produce a loud speaker remarkable for its rich, natural and clear tone. Songs, speeches, announcements, conversation and instrumental music are reproduced by it with a clearance and audibility which has not been the case with the majority of radio receivers.

It is rugged and simple in construction, thus insuring durability. It requires no separate storage battery or magnetizing current. In order to make the horn suitable for all types of radio amplifier circuits, a transformer is mounted in the base, which provides the impedance about equal to that of the vacuum tube amplifier, into the plate circuit of which the horn is connected. When connected to a third stage of amplification operating on 100 volts or over, the volume of sound is sufficient to be easily heard in a room seating 500 people. For smaller rooms, such as in private homes, good results are obtained from the Audiophone when connected with a two-stage amplifier.

One watt is required by this loud speaker to give full volume, therefore, the amplifier must be designed to have a high voltage in at least the last stage or better still to operate with high voltage on all tubes.

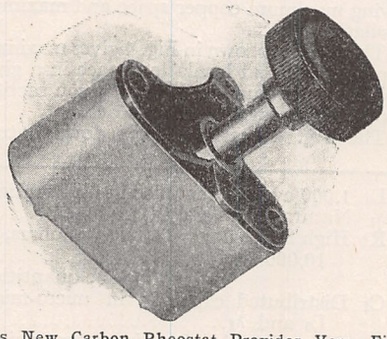
This loud speaker of novel design reproduces music and speech in a remarkably clear tone.

The Audiophone can also be used in connection with the special phonograph record transmitter and control box, for amplification of the voice or on phonograph records. This transmitter and control box will soon be placed upon the market, thus affording a double use for the Audiophone. It can be readily applied to any style of phonograph to electrically reproduce from the record the music, voice, etc., with the true musical quality, which was used in making the original master record.

(*Photograph by courtesy of the Bristol Co.*)

A New Filament Rheostat

ONE of the essential requirements for the so-called "soft" vacuum tubes, is that the regulation of the filament be very fine, even to the point that the means of regulation will provide for a smooth control of the filament current without any "steps" or "jumps" when varying the current. The ordinary wire-wound coil with a slider contact has limitations because there is a decided change in resistance when the slider moves from one turn of wire to the next. This has been overcome to a degree with the vernier attachments, but the latter usually require either two adjusting knobs or a special operation in one knob that slows up the action and interferes with quick tuning for the best audibility.



This New Carbon Rheostat Provides Very Fine Adjustment of the Filament Current of a Tube.

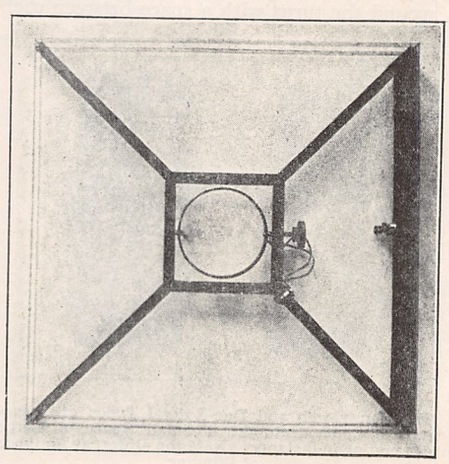
The ideal rheostat is one that will give an absolutely smooth variation in current with a simple one-way adjustment. The most natural way to accomplish this is by the use of a compression type rheostat. A rheostat of this nature, especially designed to meet the requirements of one-half and one ampere receiving detector and amplifier tubes and the 5-watt power tubes, has just been placed on the market by a Milwaukee concern. A column of specially treated graphite discs assembled in a porcelain container form the resistance element in this new device. The resistance of the graphite discs varies with the pressure applied through means of an adjusting knob and pressure screw. It will

(*Continued on page* 179)

"Loop Coupler"—New Receiver

SIGHTLINESS, compactness and efficiency are the admirable qualities conserved in a radio-receiving loop designed by L. M. Dunnam of Washington, D. C., whose invention justifies the belief that an application for a patent will be granted as a cloak of protection for this product of an inventive mind. When the trend of developments in the designing of appliances of radio-telephony and radio-telegraphy is constantly in the direction of robbing antennæ of their cumbersomeness and unsightliness as well as the exercising of a stubborn effort to banish that bugaboo known as static or atmospheric disturbances, this convenient and serviceable design for the reception of wireless signals should elicit widespread interest.

Like other individuals who have wrestled with seemingly insurmountable difficulties, this invention of Mr. Dunnam had its inception at the crucial time when despair was struggling for supreme recognition only to be crowded out by the proverbial silver lining in the cloud. After two years of intermittent effort to vary the working arrangement of the loop in the reception of radio-telephone communications, Mr. Dunnam was about to profess undying allegiance to the theory that nothing less than an Armstrong superheterodyne circuit had the virtue of making effective the loop receiver. Then it was that a series of trying circumstances—notably, aggravating atmospheric disturbances—prodded the operator of "3ZY" to exert his su-



This loop coupler is especially designed to be used in a barrage circuit in which a loop is connected in the secondary of the receiver.

(*Continued on page* 179)

Underwriters Modify Radio Regulations

These illustrations clearly show how the lead-in of an aerial should be installed and run into the house through an insulating tube which may be fixed in a window frame or through the wall. The lower left-hand photograph illustrates the method of making the ground connection on the water-pipe, while on the right the other picture shows how the automatic lightning protector may be connected inside of the house. In two of the upper photographs is shown how an insulator should be inserted between the aerial wire and the string supporting it.

THE National Board of Fire Underwriters has made public, through its bulletin, *Safeguarding America Against Fire*, tentative regulations covering radio receiving installations that disclose considerable modification as compared with the requirements previously issued by the fire underwriters.

The specifications that follow were drawn up by a special committee of the National Fire Protection Association, which is the authority for the National Electrical Code and whose findings are standards of engineering practice. Besides the underwriting organizations represented upon this special committee, engineers acting for the American Radio Relay League, American Telephone and Telegraph Company, Radio Corporation of America and the Independent Telephone Association also participated.

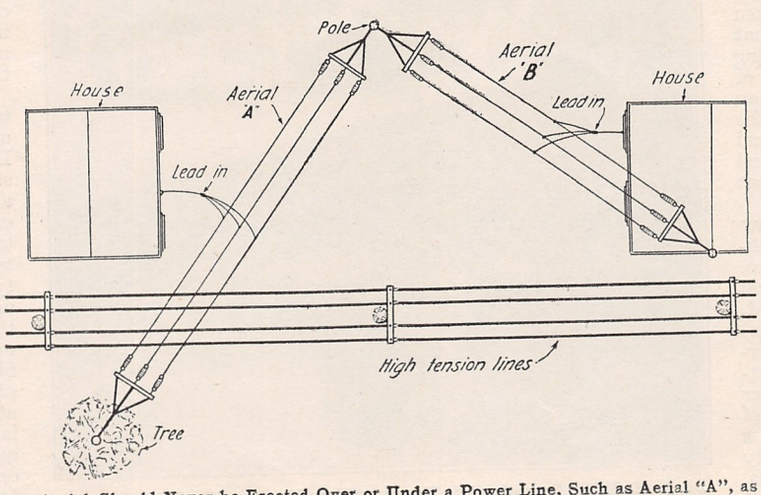
The new rules are being published as proposed amendments to be included in future editions of the Electrical Code. It is stated that the requirements contained in the current edition of the code were based largely on the hazards incident to the equipment of wireless telegraph transmitting stations where antennae of considerable height and length were used and where the hazard of high potential equipment had to be considered.

The recent widespread installation of radio telephone receiving sets has necessitated a revision of the regulations. The receiving set having an indoor antenna is considered devoid of hazard. With any receiving set, the publication says, the principal danger is from lightning brought in over the antenna to the equipment, or to some part of the building. Where there is no exterior antenna this hazard is removed.

The following specifications are for receiving stations only:—

Rule 86—National Electric Code

Specifications: (For Receiving Station Only)



An Aerial Should Never be Erected Over or Under a Power Line, Such as Aerial "A", as They May Come in Contact. The Correct Way to Install It is as Shown by Aerial "B" in This Sketch.

Antenna

a. Antenna outside of buildings shall not cross over or under electric light or power wires of any circuit carrying current of more than six hundred volts, or railway trolley or feeder wires, nor shall it be so located that a failure of either antenna or of the above mentioned electric light or power wires can result in a contact between the antenna and such electric light or power wires.

Antenna shall be constructed and installed in a strong and durable manner and shall be so located as to prevent accidental contact with light and power wires by sagging or swinging.

Splices and joints in the antenna span, unless made with approved clamps or splicing devices, shall be soldered.

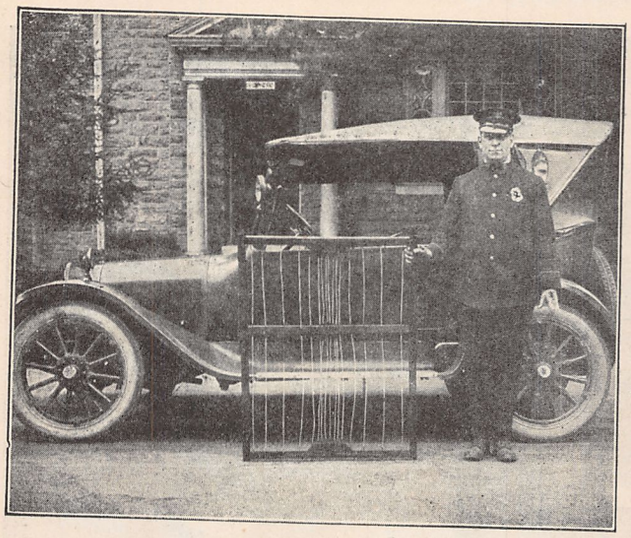
Antenna installed inside of buildings are not covered by the above specifications.

Lead-In Wires

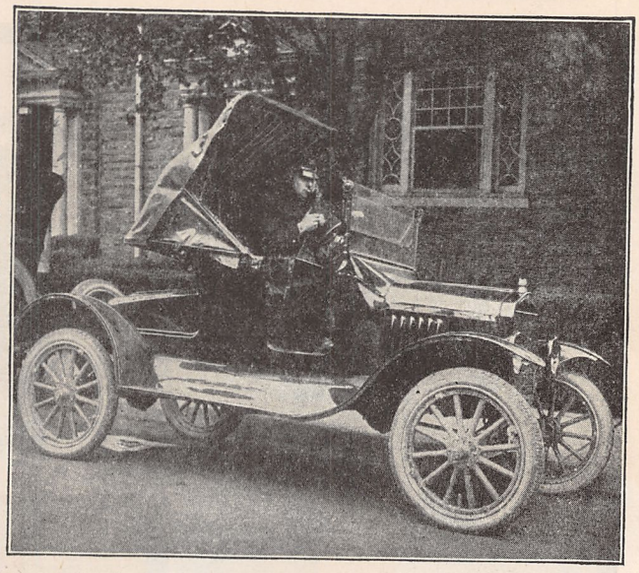
b. Lead-in wires shall be of

(*Continued on page* 170)

Ogontz Police Auto Now Carries Radio



A new system of audio frequency telephone has been installed in this automobile, enabling the driver to keep in touch with a base.



THROUGH a wireless telephone apparatus installed in the Cheltenham township police station in Ogontz, it is now possible for police to keep in direct touch with headquarters and to carry on a conversation from a stationary point along their beats or from the department's automobile, which also has been provided with a sending and receiving set.

The apparatus is the invention of William W. MacFarlane, Church Road, Elkins Park. It is a refinement of the "stovepipe wireless" that was given wide publicity three years ago.

At that time, the apparatus consisted of the usual telephone transmitter and receivers, a twelve-pound box which contained the secret batteries and coils, and an aerial consisting of three upright pieces of stovepipe on a board. Mr. MacFarlane astounded scientists by carrying on a conversation from a rapidly moving automobile with his wife who was in their garage at Elkins Park.

The automobile is equipped with a small aerial fastened inside the top of the car, ordinary telephone receivers and transmitter connected to it by a single wire, and a box not much larger than a cigar box containing battery and coils. The set weighs about five pounds, and is grounded on the ignition key on the dash.

The set is always ready for instant use, as it requires no delicate adjustments to get the proper wave-length. All the power necessary to transmit a message is furnished by a 12-volt dry battery. An ordinary umbrella will serve as an aerial, Mr. MacFarlane has dis-

(*Continued on page* 104)

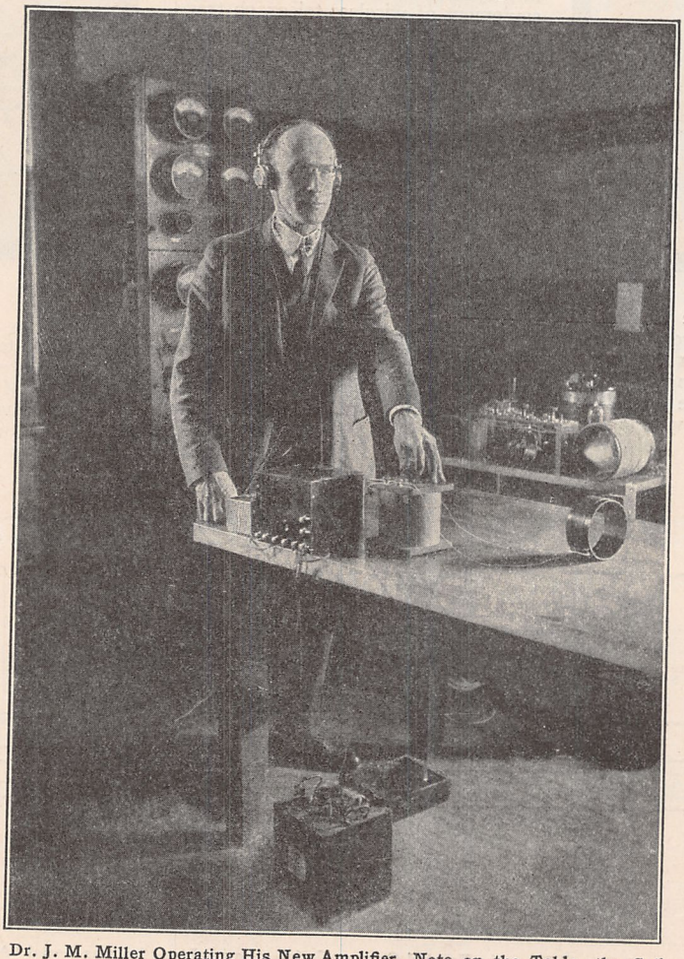
Universal Amplifier Invented

By S. R. WINTERS

AMPLIFY is derived from two Latin words, *amplus* and *facio*, which in conjunction signify to make large. Amplifier and amplification—the former apparatus for enlarging the signals transmitted by radio-telephony and radio-telegraphy and the latter term employed to indicate varying degrees of enlargement of vibrations of sound—are bandied about with such frequency today as to permit of their entry in the lexicon of household words.

Deprive a radio-receiving outfit of its stages of amplification and you have robbed the apparatus of its sustaining strength and rendered a broadcasting service futile. To employ analogies, it is like taking the heart out of a watermelon or eliminating Hamlet from Shakespeare's drama of that designation. The increasing popularity of the services of broadcasting stations causes an interested public to express the desire that the volume of vocal speech and music thus distributed be equal to or approach that of a common phonograph.

Hence the introduction of any discovery of a new form of amplifier is not lacking for an audience. All of which brings into formal review an invention of Dr. J. M. Miller of the radio research laboratory of the Bureau of Engineering, United States Navy Department. A radio frequency amplifier which embraces a wide range of wave lengths employed in wireless signaling, and insuring uniformity of enlargement of these signals, are among the virtues claimed for this newly built apparatus. With deference to its peculiar merits, the term "universal amplifier" is applied to the device.



Dr. J. M. Miller Operating His New Amplifier. Note on the Table the Coil Which is Used As a Loop Aerial.

It functions between a wave length range of 800 to 20,000 meters, and within this circumscribed area yields a uniform amplification equal to the maximum enlargement of signals afforded by the transformer design of amplifier. It was not designed to magnify low frequencies and is, therefore, classified as an extremely quiet amplifier. Despite this tendency, however, at wave lengths below 800 and even as short as 150 meters, the signals may be amplified at a correspondingly reduced volume. Modifications or further improvements of the vacuum tubes employed in this new amplifier will likely make possible its effective operation at abbreviated wave lengths.

The type, subject to manufacture in quantity production for use by the United States Navy Department, employs eight stages—five of radio frequency amplification, a detector, and two of audio enlargement. The vacuum tubes used, described as peanut tubes by reason of their similarity in size and formation to this underground growth, involve the consumption of a small filament current. To be exact, the filament supply for the whole amplifier requires only two amperes at two volts. The plate supply is 22.5 volts. The instrument is quite stable in operation, the model on display having been subjected to as many as six stages of radio.

(*Continued on page* 102)

Radio Everywhere

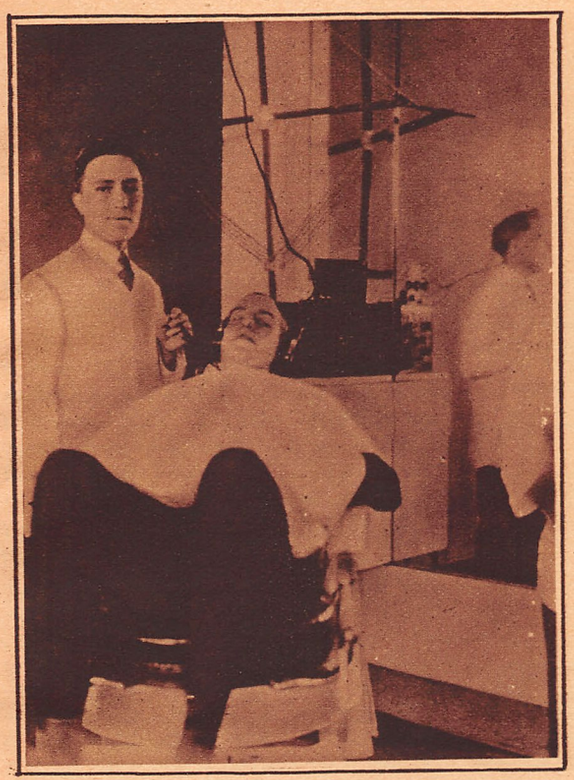
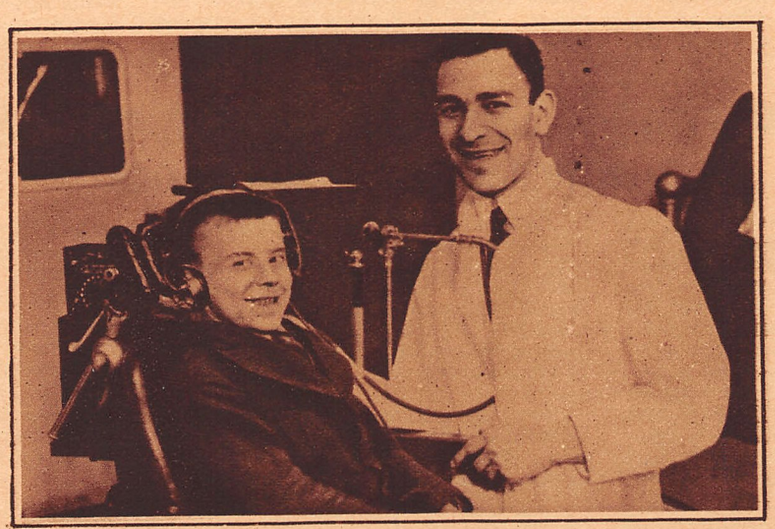


Photo by P. & A.

Radio Follows Wherever One Goes. The Barber and Bootblack Entertain Their Customers by Radio and the Kiddies Don't Mind the Pain When the Dentist Lets Them Hear the Wireless Music.

Photo by Underwood & Underwood

DR. De Forest claims that in 1927 there will be 23,000,000 people listening in to radio concerts, but if things keep on at their present pace, there will be more than that number in a few months. Radio appears daily in new and in the least expected places. An enterprising bootblack in Oakland, California, lately installed a receiver and now gives free concerts to his patrons. One customer had three shines in succession while he listened out some particular selection. So far, we have not heard of anybody becoming so enthralled in the radio music that he absentmindedly let the dentist pull all his teeth



out, but, nevertheless, the old "laughing gas" of the dentist's chair has given place to a new form of mild amusement. It is more pleasing to take and a pair of receivers on the ears replace the old gas-mask. The patient is so interested in the radio music that he forgets about the dentist and the pain. Even those who have been forced to suffer in silence or mild acquiescence the rambling gossip and advice of the barber may soon find relief in radio. Already one barber has installed a receiver in his shop and the baseball fans will be able to get the scores up-to-date while being shaved.

Photo by Fotograms

Protection Against Danger From Atmospheric Electricity

By G. K. THOMPSON*

IF your radio installation is not already installed according to regulations, you should attend to the matter at once. The regulations are in force the year round and should be complied with as far as possible. That they are not complied with is a well-known fact, but this negligence means that, after the first thunder clap, thousands of people will storm dealers in radio equipment for protective devices and their meager supplies will be exhausted within a few hours.

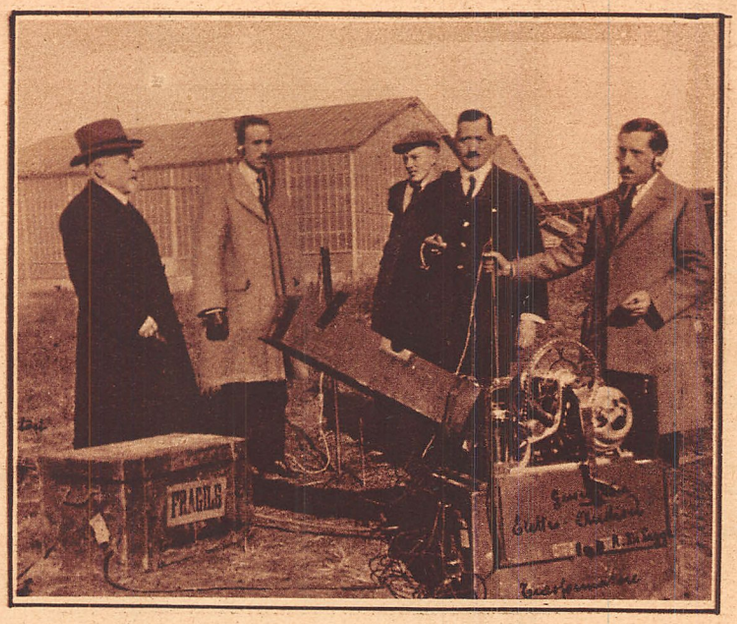
One of the first questions which comes into the mind of the would-be radio user concerns lightning. "Will my antenna attract lightning and cause my home to be struck?" he asks. To the general public wireless and lightning seem to be twin brothers—probably because the manifestations of both are uncanny and mysterious. Hoisting a radio antenna over your property does not endanger your dwelling, your instruments, or your family if a few simple precautions are observed. You have never felt apprehensive over the presence of the telephone wire running from the pole on the sidewalk to your house. You do not regard the bell wire circuit running from the front door to the kitchen as a lightning conductor, nor have you been nervous over the presence of a wire clothes line in your back yard, the tin roof over your head or the metal gutters and leader pipes. All these common and familiar metal surfaces and conductors will convey electricity from point to point. The average radio antenna differs very little from these other conductors and objects, and in so far as lightning is concerned the radio antenna is much less likely to be struck during a heavy thunder storm.

Let us consider the electrical action which takes place in the antenna before and during a summer thunder storm. There is always a certain amount of atmospheric electricity present in the air. In cold weather the amount is very slight and manifests itself in the radio set by what is familiarly known as

(*Continued on page* 84)

**Radio Superintendent of the Amrad Company.*

Prospecting by Radio



By Means of This Apparatus it is Possible to Locate Mineral Deposits Under the Earth by Radio

A NEW application of a well-known principle has lately been made in Europe for the location by radio of mineral deposits under the surface of the earth. Hitherto, apparatus for this purpose has transmitted damped waves, but the new scheme utilizes continuous waves. From the transmitting apparatus, two wires are extended in either direction a considerable distance. The end of each wire connects to a metal plate held by insulators just above the surface of the earth. These metal plates are known as diffusers. When continuous waves are generated by the transmitter, the earth acts as the opposite plate of a condenser formed in conjunction with the diffusers. The oscillations are propagated through the subterranean strata at a variable depth which may be as much as one thousand meters. On account of the patent situation, full details of the apparatus are not available, but in general, the principle involved is the recording of the variations of this capacity, caused by the presence of minerals under the surface. If the waves meet a mineralized vein or any kind of deposit, which is a good conductor of electricity, the phenomenon of reflection takes place and part of the waves is reflected back to the surface. This is recorded by special instruments.

The theory of this method of locating minerals is not new. It has long been known and applied by inventors. This, however, is a new application of the theory and shows promise of being the most sensitive and practicable yet advanced.

In experiments in the Pelvo mountains, at an altitude of ten thousand feet, an important iron vein was recently discovered by this apparatus. The experiments were under the supervision of Mr. Cesare Rovere, mining engineer of an important mining company. In another official experiment before engineers, the presence of water was shown in the Valley of the Stura and in another place on Mt. Duluc a spring was discovered. At the present time, experiments are being made in the presence of University professors and mining engineers to demonstrate the use of this apparatus.

Department Store Broadcasting Station

By HERBERT WARREN DODGE

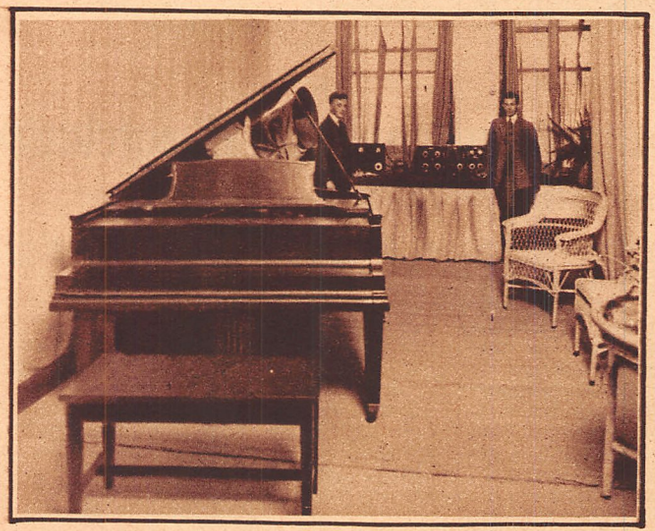
"HELLO! Hello! This is KSL, the Emporium in San Francisco, broadcasting." These words may be heard within a radius of about seven hundred miles from San Francisco whenever the station at the Emporium, San Francisco's largest department store, is transmitting.

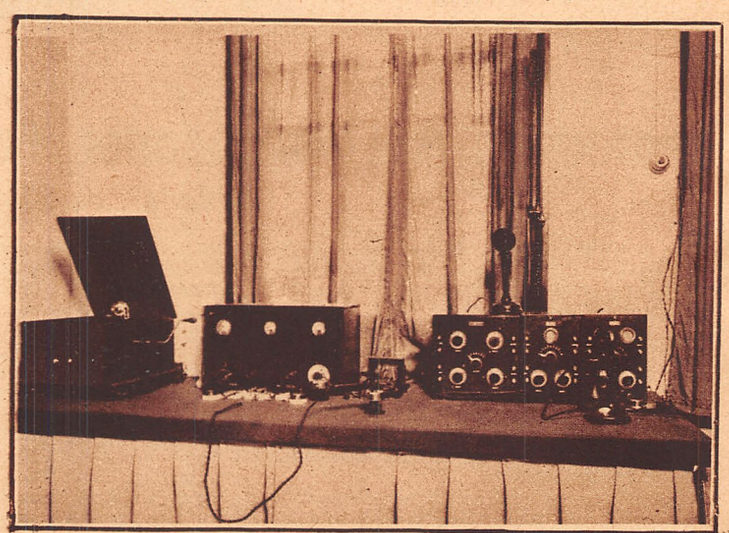
The installation at KSL includes a five-watt transmitter and a two-stage amplifier for reception. Excellent results have been obtained since the station has been in operation, reports that the signals were loud having been received from Vancouver, Washington, and other distant points along the Pacific Coast.

The antenna, located on the roof high above Market Street, is a four-wire, 70' long, T type with an 80' cage lead-in. An added advantage is a 12-wire counterpoise constructed immediately beneath the aerial. The broadcasting wave of the antenna is 360 meters.

Using 500 volts on the plate circuit, a radiation of one and a half amperes is obtained; this apparatus employs the Heising Circuit. The radiophone was designed and built by Harold R. Shaw, a local radio operator, who has charge of the Emporium's equipment. Shaw, assisted by Harrison Holliway, the operator of the set, has arranged a regular program, and every morning between 10:00 and 11:00 o'clock phonograph music and press news from the San Francisco *Chronicle* are transmitted. At this hour also Mrs. L. Holcombe, food expert for the store, speaks on the preparation and care of food and gives a tested recipe daily.

(*Continued on page* 94)





The Well-Appointed Studio of a San Francisco Department Store, From Which Music and Speeches are Broadcasted, and a Close-up of the Transmitting and Receiving Apparatus. The Transmitter is Only a Low Power One, But Has Been Heard Fairly Long Distances; Many Prominent Men Have Addressed the Radio Audience From This Studio.

Broadcasting by Wired Wireless

By CARL H. BUTMAN

MAJOR GENERAL G. O. SQUIER, Chief Signal Officer of the Army, has recently extended his experiments with "wired wireless," using the wires of an electric light system as a receiving antenna. This system, which he terms the "fish pond" method of receiving, was explained in an exclusive interview recently.

The ordinary commercial electric light lines always have a return wire running in close proximity throughout the circuit, giving a distributive capacity, and such a line may be considered as a reservoir comprising all values of antennæ. The receiving instrument, when plugged into a socket, possesses the power of "picking out" or choosing from this reservoir the particular antenna necessary for resonance at any particular wave-length. This may be called the "fish pond" theory, General Squier says, in which one can either take from the pond a whale or a minnow, depending on the particular wave-length being received. The longer wave-length might be considered whales and the shorter ones minnows, the receiving operator adjusting his instrument to maximum loudness as usual.

Photo by Harris Ewing

Major General Geo. O. Squier, Demonstrating His New Invention for Broadcasting Locally by Means of Wired Wireless on the Electric Light System. General Squier Is Starting and Stopping the Radio Telephone Messages by Pulling the Light Chain on His Desk Lamp.

The use of the lighting circuit—eliminating unnecessary wires—instead of aerials for receiving broadcasted messages, serves to reduce static very materially. In the summer this static becomes very much more active than in the winter, and makes receiving with aerials difficult, if not impossible.

There is no necessity for any wires at all except the lighting circuit and the usual flexible lamp cord to the ordinary socket. This method will be a benefit to our skylines, as it will eliminate the necessity of all receiving antennæ which now literally cover the roofs of apartment houses and private dwellings, meeting with the disapproval of architects and community beautifiers. The elimination of aerials also precludes certain dangers from possible contact with high-power electric lines.

(*Continued on page 145*)

Summertime Radio

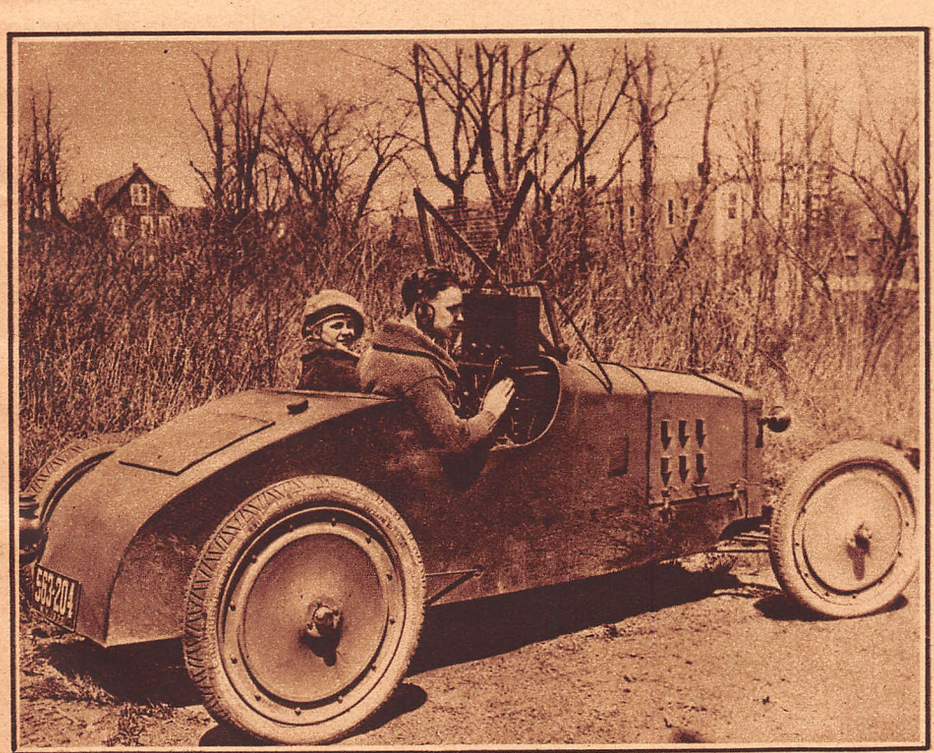


Photo by Keystone

When You Go Away This Summer Don't Forget to Take a Radio Set Along, and, Like the Boy on the Right, String Up an Antenna and Listen In. If This Cramps Your Style, Fix Up the Wind Shield of Your Automobile With a Loop Aerial and You Can Receive the Concerts While Speeding Along the Country Roads.

Radio Minerals

Or a Short Mineralogy of Radio

By DR. E. BADE

ALTHOUGH plants are more or less restricted by climatic conditions, and animals are influenced both by environment and the existing vegetation, minerals are not dependent upon any such conditions. They are found just as well in dry, barren wastes as in the most moist and damp soils. Then, too, as one goes deeper into such mines, the seepage of water is such, that, were it not for the eternal vigilance of the pumps, they would soon be flooded, and covered with water. Still other minerals are found below the waters of lakes, rivers and ocean beds. The type of mineral may be the same in both places, but not its form. The physical-chemical action must be different in the dry, desert-like region from those of a moderate or heavy rainfall, but the difference in such weathering, decomposition and decay, are not sufficient to warrant a regional classification.

In spite of this, certain types of minerals are more or less restricted, not only because of physical-chemical characteristics, but by a freak of nature. Monazite sand, containing thorium and cerium are found principally in North and South Carolina and in Brazil. Tellurium, sometimes used as a detector in radio, is just as rare and is restricted to Colorado and Transylvania, while yttrium is principally mined in Sweden. And so it is with a large number of minerals, not only of economic importance but also of scientific value, and in addition many of them are most important because of their electrical properties which make them much sought after for radio work.

It is a peculiar fact that many minerals become electrified under the most unique conditions imaginable although the stone, ordinarily, may be a non-conductor. Any kind or type of mineral may be made electric by simply rubbing it vigorously, and, if care is taken to insulate it perfectly, the stone can be made to lift bits of paper. Others develop electric charges when heated and on some of these, the positive pole becomes the negative pole and the negative the positive, upon cooling. This can easily be proven by iron dust or filings sprayed on insulated and perfect hemimorphic crystals. In the same way still other minerals become electric through pressure, cleaving, tearing, etc., and the quantity which a given mineral may generate is sufficient to be perceptible, if care is taken to prevent grounding, to be detected by the crudest of apparatus.

Under such conditions it is not at all surprising that still other minerals were found which had the inherent property of allowing an electric current to flow more freely in one direction than in another. This unilateral conductivity rectifies high frequency waves. If such a crystal is inserted in a radio receiving station as a detector, the intercepted energy of the aerial is rectified by the mineral and the resulting current actuates the phones.

Magnified Views of Various Crystals Having Rectifying Properties. The Upper Photographs Show, on the Left a Sample of Galenit and on the Right a Piece of Markasit. The Lower Pictures are, on the Left a Carborundum Crystal and on the Right a Piece of Silicium, also called Silicon.

The most common of these crystal detectors are the sulphur compounds of the heavier metals of lead, copper, iron and molybdenum.

The sulphide of lead (galena) is widely distributed in nature, being not only commonly found in massive cleavable masses, but also in cubic crystals. Strange to say, this vein mineral is not mined so much for its content of lead as for the silver which is associated with it, the lead produced being only an incidental product of manufacture. The greatest importance of galena does not lie in its value as a detector for which a crystal or a small fragment is taken, but as one of the ingredients in the manufacture of soft glass, and as a glaze for pottery. It is also extensively used for pipes, and one third of the annual production of lead is used in making paint and is permanently lost.

The sulphides of iron, pyrite and markasite, also exhibit unilateral conductivity and are, therefore, employed, to a small extent, in radio. The former are cubic, while the latter give spear-shaped groups. These two types of minerals are of little value, either scientifically or commercially, although both are used in the manufacture of sulphuric acid and copperas.

The sulphides of copper used in wireless are always chemically united with iron. Chalcopyrite and bornite, both important ores for copper, although rarely found in crystals, are widely distributed, one half of the world's supply being mined in Montana, Michigan and Arizona.

Another sulphide used for the same purpose is molybdenite, an important ore of molybdenum which is widely distributed. It is seldom found in quantities sufficiently large to be commercially mined. The greatest value of this element lies in its property of hardening steel, as a fireproofing material, as a coloring for leather and rubber, and as a reagent for the detection and determination of phosphorus in fertilizers. Certain oxides, namely those of zinc, copper, and lead, are also used to rectify the high frequency currents that are introduced in a receiving circuit by the radio waves.

Zincite, the zinc oxide is rarely found in crystals, being much more common in its massive state. It is principally mined in New Jersey and its use is more or less restricted to the production of zinc white. A tiny crystal of this substance is occasionally arranged so that a point of it will form a contact with either bornite or chalcopyrite. Such a combination is known as a pericon detector.

More profuse in the formation of crystals, although they are not any too plentiful, is copper oxide, cuprite. Although the ore is usually massive, fine specimens of cubic, octahedron and dodecahedron crystals are found, and these come from such widely scattered places as Bisbee, Arizona; Cornwall, England; Chessy, France; and the Ural Mountain region. The transparent crystals are ruby-red and have a high index of refraction, which gives them a brilliant luster. The softness of this stone is all that prevents it from becoming a beautiful gem material.

Lead carbonate, cerussite, which is lead oxide plus carbon dioxide, has been widely employed as a detector by the Marconi Co It is commonly found in crystals, which vary in form. It is a secondary mineral being formed by the decomposition of galena by waters charged with carbonic acid gas, and as such it is found in the upper oxidized zone of lead veins. It is a mineral of wide distribution and of great economic importance as a source of lead.

Then, too, certain elements such as silicon, tellurium, boron, and arsenic, are also used as rectifying detectors. Some of these are native minerals, others are artificial products.

The most common type of these detectors is silicon, which does not occur free in nature although next to oxygen it is the most abundant element. It is chiefly found as the oxide, quartz. This mineral is taken in the form of sand and, after mixing with coke, it is heated to a very high temperature in the electric furnace. Carbon monoxide is given

(*Continued on Page* 146)

WHAT IS IT?

Can You Guess What This Is? It Looks Like an Old Village of the Incas in the Mountains Seen From an Airplane, a Dead Greek City, or an Eagle's Nest-like Convent of Thibet Inaccessibly Perched on Top of a High Peak. It Might Also Be a Quarry, or the Result of an Earthquake. To Find Out Exactly What it Represents Turn to Page 203 and You Will Learn. From an Actual Photograph.

How Time Signals Are Broadcasted by Radio

By S. R. WINTERS

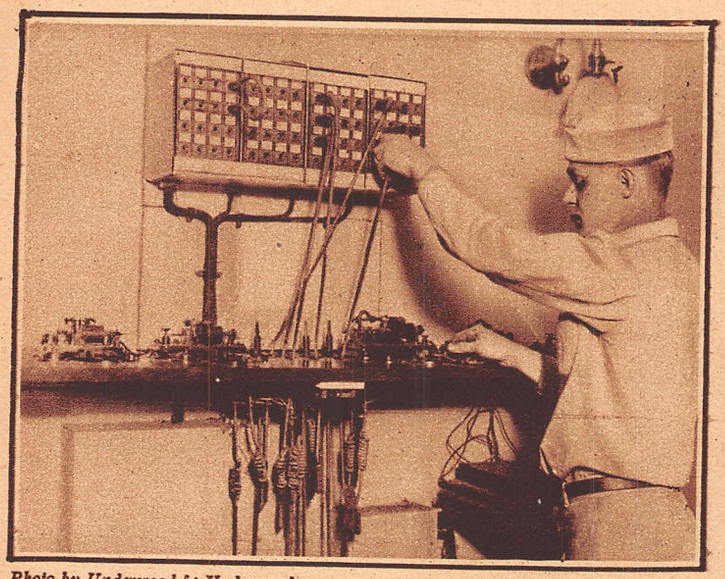


Photo by Underwood & Underwood

Connecting up the Relay to Send Out the Time Signals from the Naval Observatory Clock. The Signals are Sent Automatically.

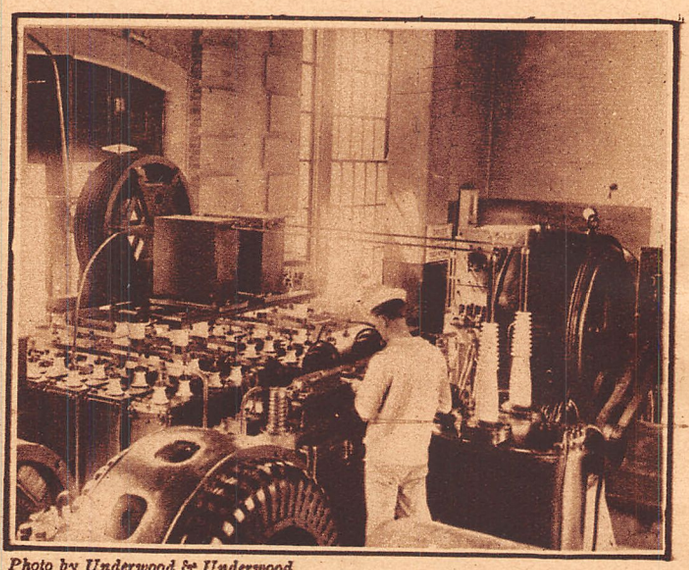


Photo by Underwood & Underwood

This "German Telefunken" 60-k.w. Spark Set, Used by the Germans Before the War at Sayville, L. I., is Now Held in Reserve at the Naval Radio Station at Arlington, Va., in Case the Large 100-k. w. Set Breaks Down.

MUSIC, results of baseball games by innings, bed-time stories, Government market and weather reports, current events as told in press dispatches, and probably another melodious rendition or musical composition. With slight variations from day to day and allowances for speeches and sermons, this variety of things as mirrored by life is representative of an evening broadcasting program through the medium of the wonders of wireless waves. Climaxing this schedule of offerings, is the prosaic announcement—"9.55 to 10.00 P. M.—Arlington Time Signals."

Probably, the beneficiaries of the 500,000 radio receiving sets—or shall I compute the number at a round one million when this article makes its appearance—never made inquiry as to the fountain source of standard time which may be received by means of radio-telegraphy and radio-telephony. Really, the term "Arlington Time Signals" is a misnomer; equally misleading is the phrase "Annapolis Time Signals." Pertinent to this popular conception that the science of time has its source either at Arlington or Annapolis, is an observation of Captain W. D. MacDougall, superintendent of the Naval Observatory, that if these notions persist there is apt to gain currency a belief that time signals transmitted from Arlington and Annapolis are at variance. As a matter of fact, the signals transmitted from these two points are identical, both having a common origin at the Naval Observatory. And thereby hangs a tale!

Situated on a commanding hill, at Thirty-fourth Street and Massachusetts Avenue, Northwest, Washington, D. C., is the Naval Observatory, where Father Time is a subject of scientific treatment. A white dome that rears itself upward identifies the Observatory to the visitor on his original quest of the scientists and physical equipment dedicated to the determination of that fleeting period we know as Time. Here, on this elevated point, removed from obstructions that would mar the view, time is reckoned by the observation of certain stars as they cross the meridian of Washington. Three master clocks are retained in an underground vault as a means of gauging the progress of Father Time; these timepieces being maintained in subterranean quarters as a means of insuring their operation at a constant temperature. Absence of fluctuations of heat and cold is essential to a constant rate of ticking-off the seconds, minutes and hours.

Sidereal time—meaning observations made by the apparent motion of the stars—is carried by these master clocks. Faithful records are preserved of these Riefler timepieces, their errors and daily rates of movements being accurately known. No attempt is made to have them carry the correct time, as their errors and rates are known at all times. These are readily applicable to the clock readings. A year consists of 365¼ solar days or 366¼ sidereal days. Thus a sidereal day is shorter than a solar day—a difference of three minutes and fifty-seven seconds, to be exact. At the Vernal Equinox, occurring about March 21 during each year, the sidereal and solar times coincide. Then, the correct local sidereal time at the Naval Observatory having been determined, the corresponding local mean time is readily obtained. To this is applied the difference in longitude—eight minutes and 15.17 seconds—between the Naval Observatory and the 75th meridian giving Eastern standard or 75th meridian mean time. As is well known, there are four time zones in the United States, their allocations being with respect to geographical divisions. The Eastern zone is allotted the time of the 75th meridian, the Central zone assigned the 90th meridian, the Rocky Mountain zone that of the 105th meridian, and the Pacific zone the time of the 120th meridian.

So much for the methods of reckoning the progress of Father Time and the allocations of his fleeting qualities to certain geographical limitations. Now, to pick up the main thread of this story, we will repeat the title of this article, "How Time Signals Are Broadcasted by Radio," and proceed with the explicative text. Eastern standard or 75th meridian mean time is kept by the Naval Observatory on two transmitting clocks located on the first floor of this time-observing institution. These two timepieces are paired; in the event of one being put out of commission there need be no disruption of the service. This is in recognition of the proverb, "Time and tide wait for no man." Actually,

Time Signals from Other Radio Stations Throughout the World are Received at the Naval Observatory and Comparisons Made.

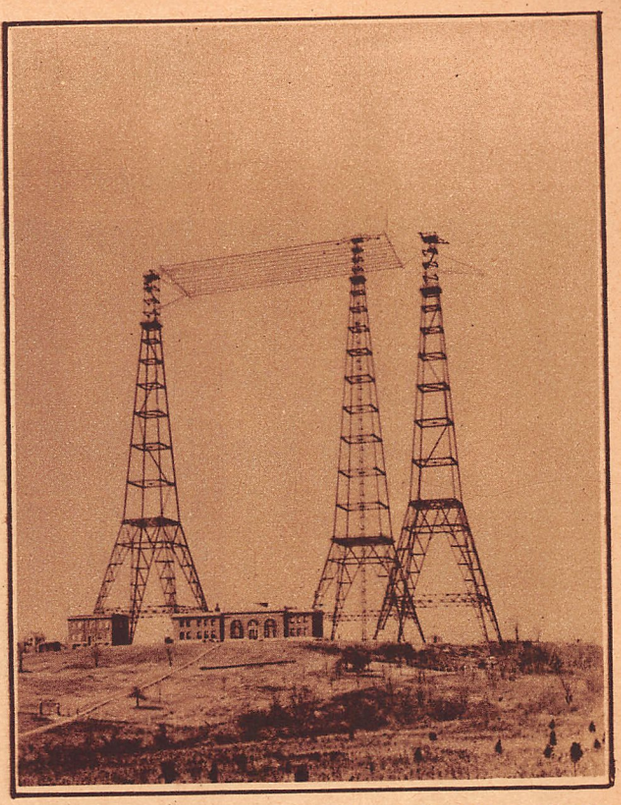
only one of these clocks at a time is employed in transmitting time signals, the transmission being effected through the operation of a relay. The ticks of this transmitting clock are broadcasted by both radio-telegraph and common telegraph systems from 11.55 A. M. to Noon and from 9.55 P. M. to 10.00 P. M. daily.

A chronograph in the Naval Observatory records the signals dispatched by the transmitting clock and also notes the ticking of one of the standard master clocks, in the underground vault, which serves as a comparison in the interests of accuracy. By automatic electrical connections with Annapolis, Arlington and Key West, the daily time signals are transmitted from the Naval Observatory to these radio stations. Also, the Western Union and Postal Telegraph Companies receive the signals for distribution to all parts of the United States. Simultaneously, with the broadcasting of the time signals from Annapolis, Arlington, and Key West, the chronograph in the Naval Observatory is functioning and this instrument may be assigned to the task of receiving the outgoing signals, recording the periods of departure of the latter from the radio-telegraph sending sets. This information may be recorded on the same sheet of paper with the data relating to the behavior of the clocks in the Naval Observatory.

Not only are comparative records of the actions of the clocks maintained, but the lag in the relay between the Naval Observatory and the arc-transmitters at Annapolis, Arlington and Key West is determined. In advance of the beginning of the transmission of the time signals from the Naval Observatory, the operator measures with a finely-divided metal scale the variation between the ticks of the standard master clock, in the underground vault, and the ticks of the transmitting timepiece on the first floor of the Naval Observatory. Having previously determined the correction to apply to the clock in the vault to make the transmitting timepiece read accurately, the latter may be speeded up or slowed down as preciseness may indicate by the operation of an electromagnet acting through the pendulum of the timepiece. Its beat is thus increased or retarded. In this way, the transmitting clock will indicate the precise time at the moment of dispatching the time signals. The three master timepieces, maintained in the constant temperature of subterranean environments, are electrically wound every 28 or 29 seconds. Contrary to the office and household practice, when an error is discovered in its keeping tab of the march of Father Time, these master clocks are not subject to change. Any interference with them is likely to vary their rates of movements. Of course, the error thus revealed is applied to the one employed when the time signals are sent to Annapolis, Arlington and Key West. When observations of the stars are not feasible, in the event of cloudy weather, these rates of movement may be applied to the different clocks and accurate time gauged with almost negligible error.

The time signal consists of telegraphic dashes every second, with these omissions or exceptions: The twenty-ninth of each minute; the fifty-fifth to fifty-ninth, inclusive, of the first four minutes; and the fiftieth to fifty-ninth, inclusive, of the last minute. Subsequent to the ticking-off of the fifty-ninth second of the last minute there is a long dash beginning at the outset of the incoming hour or the expiration of the old one. Radio-telegraph signals issuing from Annapolis, employing a wave-length of 16,900 meters, have been received in Australia, nearly half way around the world. Instances have been noted where these signals negotiated by the wonders of wireless waves, have been heard coming around the world both ways. The velocity of electromagnetic waves—186,300 miles per second—makes it possible for a radio-equipped ship, at sea, 3,000 miles away, to receive the time signal with a variation of less than one two-dredth of a second. The most accurate timepiece in existence is not sensitive to a fraction of time less than one-fifth of a second.

Radio-receiving apparatus in the Naval Observatory makes it possible for Paul Sollenberger of the Time Service of this government bureau to obtain time signals from European countries for comparison with those of the United States. He has exchanged signals with Australia, nearly half way around the globe. A standard Navy Department amplifier is in use, but the other receiving units are of special design or modified apparatus adapted to the purpose of using in conjunction with the chronograph. Time signals dispatched from the Naval Observatory, when compared with those of foreign countries, indicate a negligible error. During the last fiscal year, of all the signals transmitted, the error was only 0.03 second. Navigators of vessels of the United States Navy Department, as well as other ocean-plying ships, are almost daily applying the time service of the Naval Obseravtory in comparing their chronometers, a timepiece of precision. Likewise, many experiments have been conducted by radio-telegraphy in determining the longitude of remote places of the globe.



View of the Naval Radio Station at Arlington, Va., With Its Massive Towers. The Exact Time is Broadcasted Twice Daily from this Station.

Results of Sporting Events by Radio

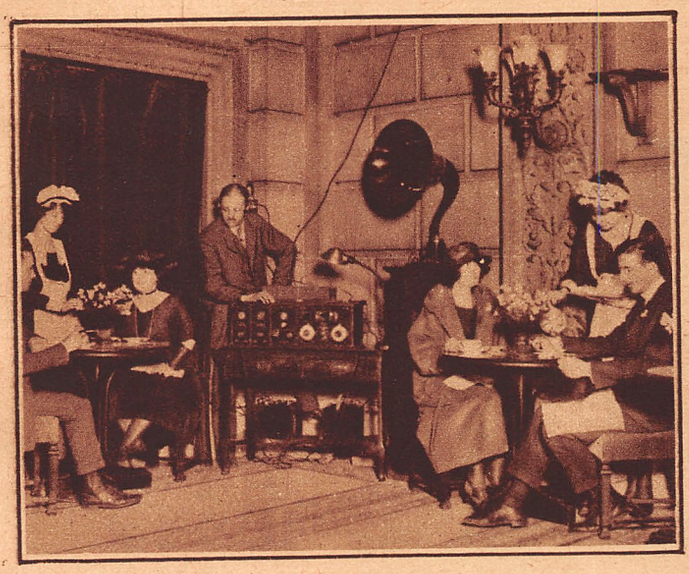


Photo by Kadel & Herbert

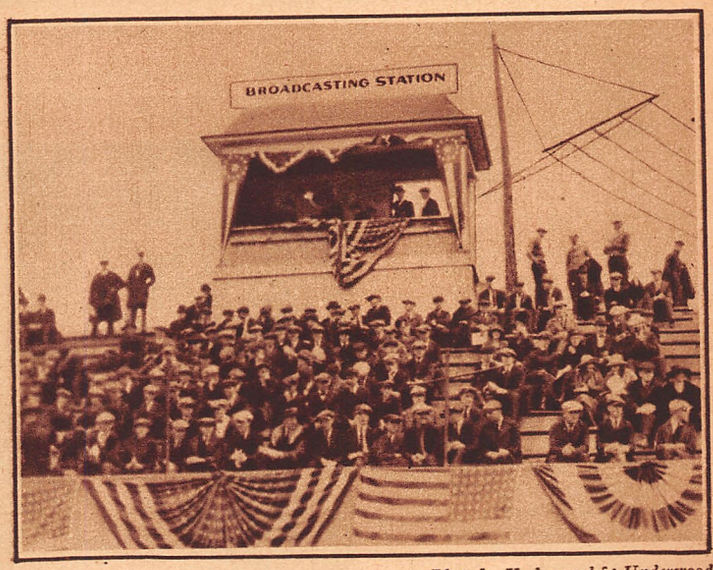
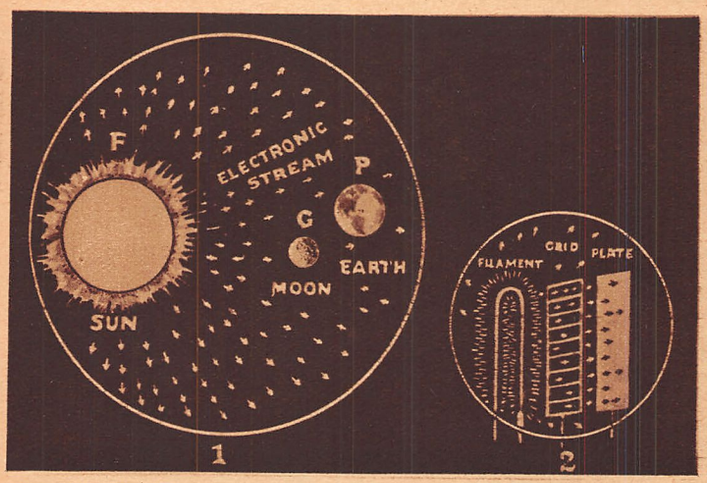


Photo by Underwood & Underwood

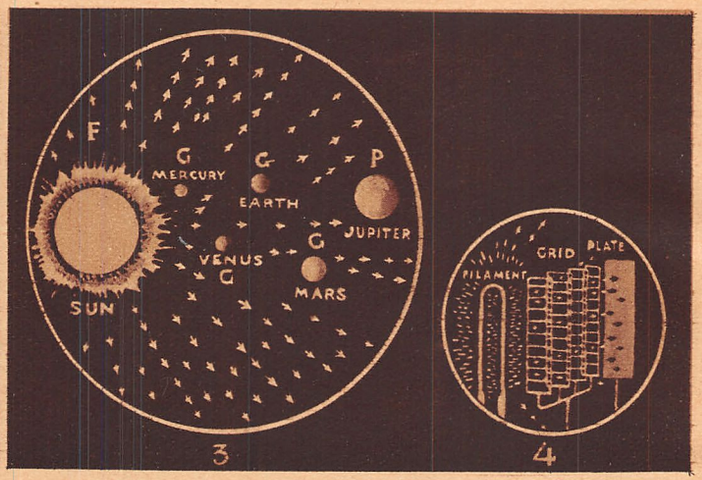
The Results of the Athletic Sports are Broadcasted Directly from this Station by Radio as Each Event Takes Place. In a New York Hotel the Results are Followed While the Listeners Drink Afternoon Tea Miles Away from the Discomforts of the Grandstand and Ticket Sellers.

A Celestial Audion

By H. GERNSBACK
Member of the American Physical Society



Everything That Happens in a Vacuum Tube is Duplicated in the Solar System. The Sun Corresponds to the Filament, the Earth to the Plate and the Moon to the Grid of an Audion.



The Various Planets of the Solar System Correspond to a Vacuum Tube in Which There are a Number of Grids. The Sun Constantly Sends Out Streams of Electrons.

"THERE is nothing new under the sun" goes the old saying, and the older it becomes the truer it is. We are wont to think, for instance, that the audion as developed by Fleming and DeForest is comparatively a new invention of not more than twenty years' standing, at the utmost.

It will probably come as a shock to most people that the audion principle is one of the oldest in the world, and dates back at least several billions of years. It shows as usual that man after all his ingenuity finds his peer in omniscient Nature.

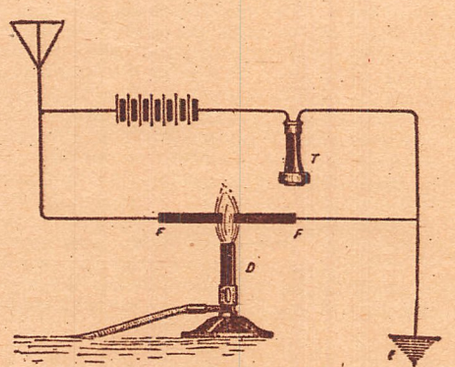
The exact counterpart of the audion or vacuum tube is found in the heavens, as will be made clear in the following:

In the audion tube we have first a filament, a grid and a plate. This will be seen from Fig. 2. The filament has the office of sending out electrons, i. e., highly charged electrical particles, which passing through the open grid, strike the plate P. This electronic bombardment goes on as long as the filament F is in full incandescence and the plate at a positive potential. We make use of an incandescent filament in the vacuum tubes of today because it is the simplest means of controlling the electronic flow.

The filament, however, is not absolutely necessary. Any glowing body heated to incandescence will do the same trick. Indeed DeForest, in his early experiments, used an ordinary Bunsen burner, as shown in one of our illustrations, to obtain an electronic flow. He found that this worked exceedingly well, the only trouble being that the gas burner was not steady enough for practical purposes.

In Fig. 2 we also find that for best results the three elements, namely the filament, grid and plate, should be enclosed in a glass vessel, the latter to be exhausted of all air. While the device works under ordinary atmospheric pressure, as demonstrated by DeForest's Bunsen burner audions, it has been found that for best results an evacuated vessel which has a very good vacuum should be used.

Now let us lift our heads from our experimental tables, heavenward. If we refer to Fig. 1, we find that all the conditions of the vacuum tube shown in Fig. 2 are duplicated in our own solar systems. The sun now becomes the filament, or the glowing body. The earth becomes the plate, while the moon, which is between the sun and the earth, becomes the grid. Nor does the analogy stop here by any means.



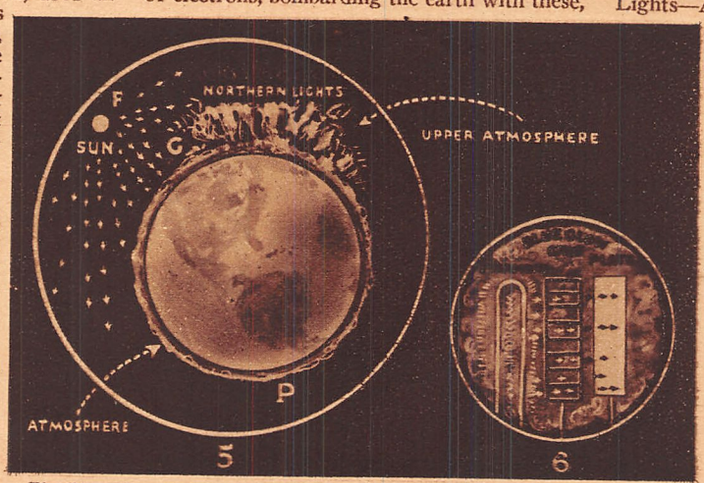
One of the Earliest Types of Audions Designed by Dr. DeForest. A Bunsen Burner Was Used for the Filament Which is the Most Primitive Form of Producing a Flow of Electrons.

As we know well, for many years the sun has been sending earthward a constant stream of electrons, bombarding the earth with these, exactly as the filament bombards the plate. The effect is not only analogous here, but it is literally so as well. As a matter of fact, the electrons sent out from the sun to the earth are not at all different from the electrons sent out from the filament of the vacuum tube. Both are identical, and both have exactly the same physical character.

The sun and its planets are moving in a vacuum, as we well know. This vacuum, scientists tell us, is far more perfect than the best vacuum we have in our vacuum tubes. For this reason, if for no other, the electronic transmission between the sun and the planets is far more efficient than that in our vacuum tubes.

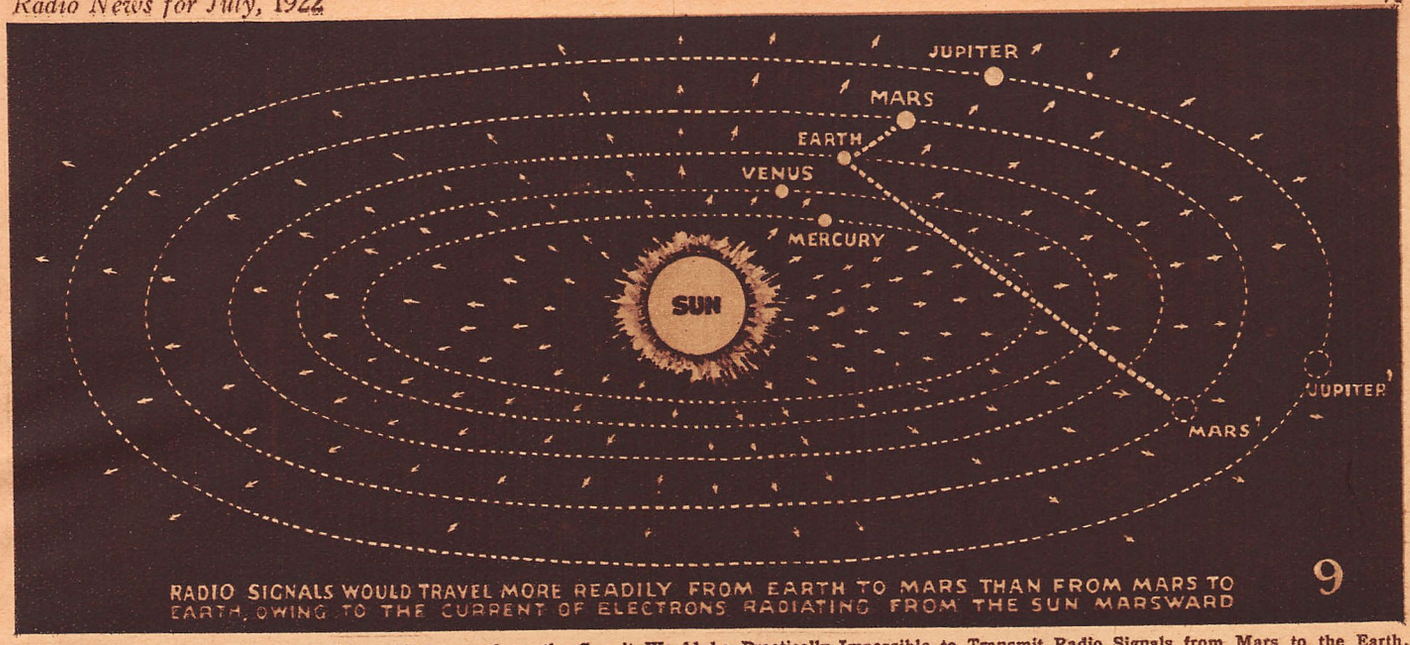
In Fig. 3, we consider the sun with the various planets as a whole, and the counterpart would be a vacuum tube with many grids, as shown in Fig. 4. If, for instance, you were located on the planet Jupiter, you could consider that Mercury, Venus, the Earth, and Mars were part of a grid, as shown in Fig. 4.

We can go still further citing another analogy. We know what happens in the average vacuum tube when the voltage becomes too high. The entire inner tube becomes enveloped in a blue glow. In technical parlance this is called "slopping over" or "running over" due to excessive voltage. This blue glow is due to the rarified gases inside of the vacuum tube. The same are our Northern Lights—Aurora Borealis—as shown in Fig. 5. These Northern Lights, as is known today, are nothing but an electrical phenomenon, the same as that which occurs in a vacuum tube. Not only that, but the cause is identical, that is, excessive voltage. On Earth, whenever we have Northern Lights they can usually be traced back to solar upheavals such as sun spots and the like. Whenever this sun spot activity starts upon the sun, the electronic flow from sun to earth becomes very much larger than usual, and the immediate effect upon the earth some hours or days later is that the rarified atmosphere extending about 200 miles beyond the poles becomes highly electrified and the blue glow is the result.



The Blue Glow Which Appears in a Vacuum Tube When the Plate Voltage is too High, Finds a Parallel in the Aurora Borealis, Which is Explained by the Increased Flow of Electrons from the Sun, Due to a Sun Spot.

Consider now Figs. 7 and 8. In this case, when the moon comes directly into the path,



On Account of the Direction of the Flow of Electrons from the Sun it Would be Practically Impossible to Transmit Radio Signals from Mars to the Earth, Although Transmission Would be Possible in the Opposite Direction.

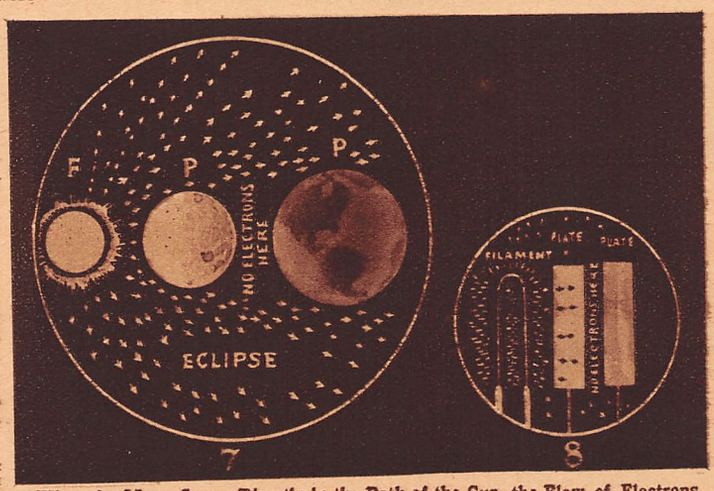
hiding the sun, we have what is termed a solar eclipse. The sun is entirely blotted out, and all electronic flow from the sun to the earth is stopped. We have the counterpart in a vacuum tube constructed as shown in Fig. 8. We know very well that if we have a positively charged plate P-1 midway between the filament and the plate P, but little current will reach the plate P. Hence the necessity of the grid.

This condition has its counterpart in the solar eclipse when not only darkness covers the earth for the path of the eclipse, but it has been actually proven that all other phenomena on earth caused by electronic transmission, are cut off as well, for the reason that the electrons cannot pass through the heavy body of the moon. As soon as the moon moves on, the old relations are established again, and we then have the true condition of filament, grid and plate.

What practical results can we take from this discussion? It would seem as though there would not be any, but there is no doubt that in years to come, practical use will be made of the idea. Just how it will come about, no one can tell. One result may be interplanetarian communication.

Consider Fig. 9. We notice that here we have the Earth and Mars opposite each other. This condition is reached during the month of June of this year when the two planets will be in opposition. It goes without saying that electro-magnetic transmission of intelligence should be relatively easy from Earth towards Mars, for the reason that *the electronic flow is in the direction of the Earth toward Mars.* Just as we are using continuous waves (carrier waves) upon which we implant speech currents in radio telephony, just so will we use in future years the sun's electronic flow as a carrier upon which to impress our radio waves, to be carried out into space.

From this diagram it will be understood that if there is a superior intelligence upon the planet Mars, why it is so tremendously difficult for them to get into communication with us. It makes no difference at which point of the orbits Mars and the Earth respectively are, Mars can never be in any position where the condition will be reversed. Mars will always have to send intelligence against electronic streams, which is almost impossible.



When the Moon Comes Directly in the Path of the Sun, the Flow of Electrons from the Sun is Stopped, Which Corresponds to an Audion in Which There is a Positively Charged Body Between the Filament and Plate.

It is as if you were trying to send the electrons in a vacuum tube from plate to filament, a thing that is almost impossible to do with a small amount of energy. Consider that the sun is sending out a tremendously large flow of electrons, and it will be realized how difficult it is for the Martians to work against the stream. It is as if an ant were trying to swim up Niagara Falls.

The same is true of all the exterior planets, as for instance Jupiter or any of the others. Wherever located in their orbits when signalling to us, they would always be sending against the stream of electrons. On the other hand Venus should be in a favorable position to send intelligence earthward, just as the earth is in a favorable position to send Marsward or to the other ex-

(*Continued on Page 76*)

Physicians at Sea Give Diagnosis by Radiophone

A RECENT survey of the medical situation in the great fleet of vessels operated by the United States Lines brings out many startling and interesting facts with respect to the greatly enhanced service of ship surgeons as a result of the perfection of wireless communication.

Today the surgeon is not only on duty constantly in caring for the ills of the passengers and crew of the the ship with which he is attached, but he is being made more and more available for consultation with all vessels within wireless call.

The surgeons of the United States Lines vessels have a more or less ocean-wide practice. In the days before the perfection of wireless the surgeon confined his activities to the vessel on which he served. Nowadays, however, he is liable to find himself aroused in the middle of the night to hasten to the wireless room and there listen to a diagnosis through the ether to which he must give his best advice.

Within the last few years investigation shows that the surgeons of the United States Lines fleet have been called upon to prescribe for a score or more cases which were brought to them through the medium of the wireless. Now that the wireless telephone has passed the experimental stage it is expected that the ship surgeons will be called upon even more extensively than heretofore.

It was aboard the steamship "America," of the United States Lines, that the first wireless telephone was installed and in two voyages it was completely demonstrated that it was a success.

Through the wireless telephone, the ship surgeon, Dr. Roy B. Henline, was told one night to give specific directions to a sick captain of a freighter 300 miles away. Dr. Henline had been aroused by the wireless operator and told that the commander of a small freight boat, who believed himself to be dying, decided he needed the services of a physician. Over the wireless telephone Dr. Henline asked for the symptoms and being informed, diagnosed the case to be one of ptomaine poison. He prescribed remedies normally carried in the medicine chest of all small vessels, and having given his medical advice, retired to his disturbed slumber. In the morning he was greeted with a wireless message of thanks from the ptomaine-smitten commander who stated that the remedies prescribed had relieved his trouble.

Among the surgeons of the Unites States Lines fleet is one who is a pioneer in wireless surgery. This is Dr. William S. Irwin,

(*Continued on Page 78*)

THIS Department is open to all readers. It matters not whether subscribers or not. All photos are judged for best arrangement and efficiency of the apparatus, neatness of connections and general appearance. In order to increase the interest in this department, we make it a rule not to publish photographs of stations unaccompanied by a picture of the owner.

We prefer dark photos to light ones. The prize winning pictures must be on prints not smaller than 5 x 7". We cannot reproduce pictures smaller than 3¼ x 3½". All pictures must bear name and address written in ink on the back. A letter of not less than 100 words giving full description of the station, aerial equipment, etc., must accompany the pictures.

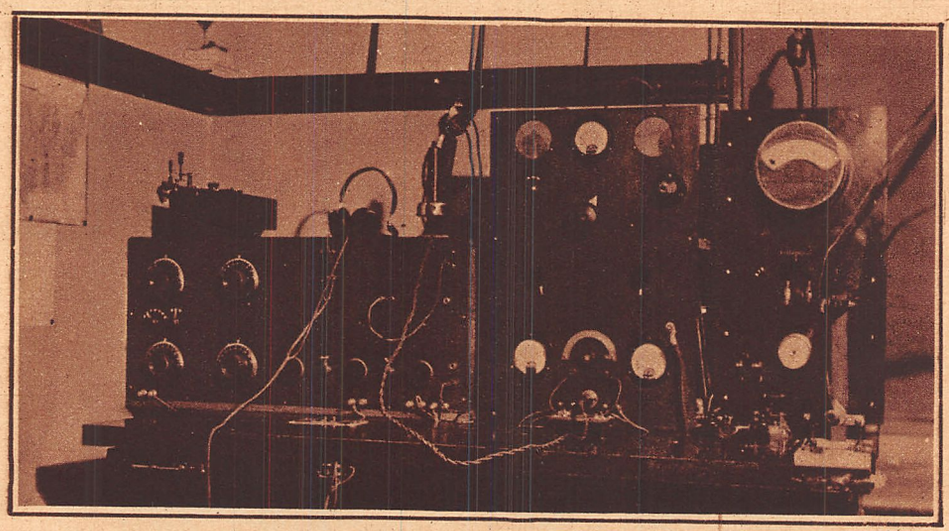
PRIZES: One first monthly prize of $5.00 All other pictures published will be paid for at the rate of $2.00.

Louis Falconi's Station 5ZA

This Month's Prize Winner

DUE to the many requests for a description of the C. W. and radiophone now used at 5ZA, this article has been written.

The present transmitter is built to take four 50-watt tubes and one 5-watt speech amplifier. For C. W., all power tubes are connected as oscillators,, for phone, two as modulators and two as oscillators, with addition of the 5-watt speech amplifier. The circuit is the Hartley. It has a common plate-antenna coil and a separate grid coil,

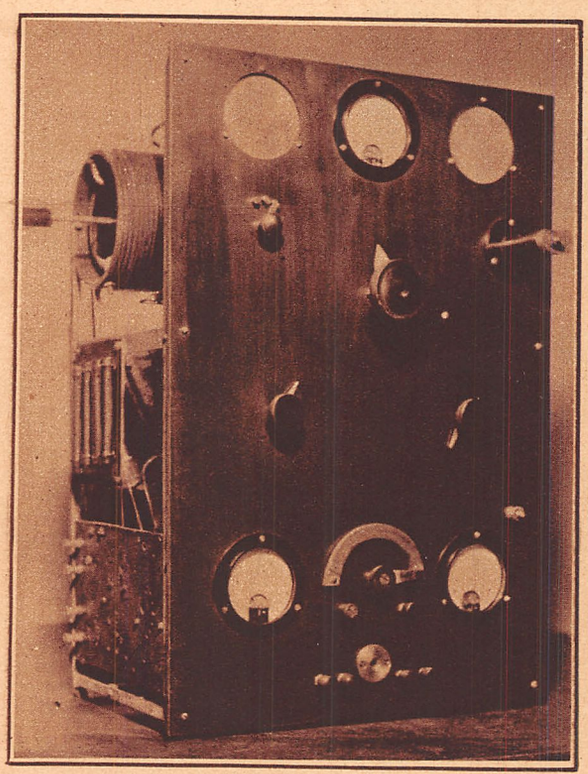


The New Station of 5ZA Looks Good. Bet He Will Break Some Records With His C. W. Set.

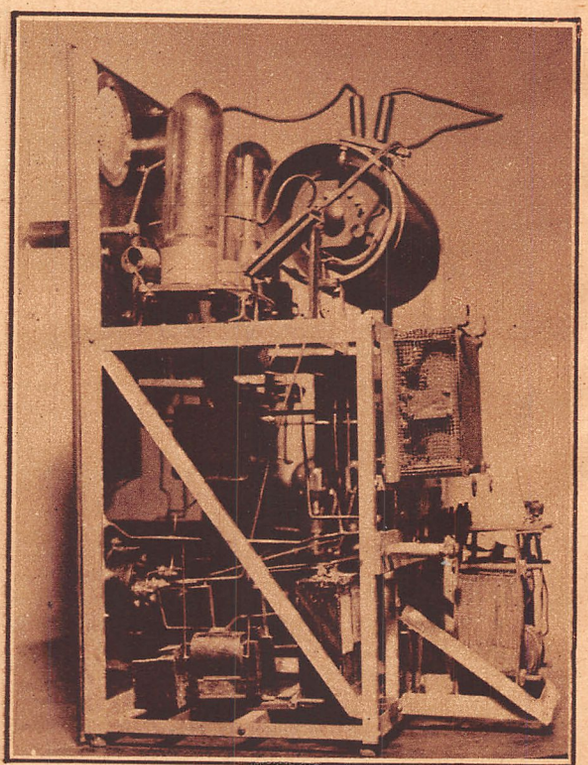
which latter is variable in coupling to the former and is adjustable in inductance. By making the grid coil adjustable in coupling and inductance, variable condensers can be eliminated and the set that much simplified. The Heising method of modulation is used. The set is designed so that it can be tuned instantly to almost any wave from 200 to 400 meters and the results seem to be equally efficient on all waves. The only disadvantage experienced with a C. W. transmitter is the trouble in calling the station desired. It is almost impossible to call any station and get an answer, unless that station happens to be right on your wave. Hence the desirability of a set that can be instantly tuned to any wave, for in that case it is only necessary to find out the wave the station you want is working on, change your set to that wave and call. Then tell him to QSY to your working wave.

To date only two 50-watt tubes have been used with addition of the 5-watt tube as amplifier for phone. With both power tubes as oscillators, the radiation is 4¼ amps. on 200 meters and 5 on 375 meters, using 1000 volts D. C. on the plates and 225

(*Continued on page 160.*)



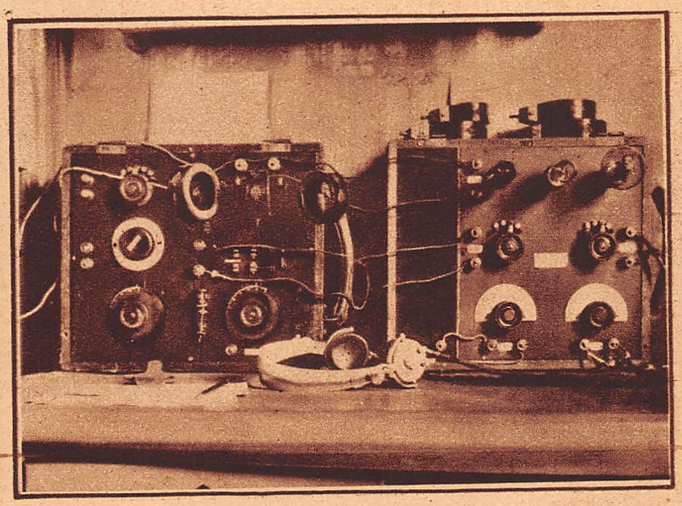
Front View of the 200-watt C. W. Transmitter Built by the Owner.



Back View of the Set in Which Four 50-watt Tubes are Used with a 5-watt Speech Amplifier.

An English Amateur Station

By Alfred Cooper



In Spite of the Restrictions on English Amateurs, Mr. Cooper has Succeeded in Designing and Constructing a Very Efficient Station. With Duo-Lateral Coils and High-Frequency Amplification He Copies Long Distances. The Transmitter Output is Limited to 10 Watts, but 50 Miles is Covered Consistently.

THE photograph shows the corner of the wireless cabin of an English amateur, whose apparatus is self-designed and constructed. English Post Office restrictions stipulate a maximum length of 100′ aerial at a maximum height of 100′. This means that amplification is desirable, and high-frequency methods have proved the most efficient under varying conditions of static which are met with in the British Isles.

Amateur transmitting stations are allowed the use of two wave-lengths: 180 and 1,000 meters. The majority of experimenters, not wisely perhaps, have chosen the latter wave for general use, and so this offers no difficulty in the design of high-frequency amplifiers which can be used for the reception of medium and long-wave messages.

The receiving set consists of a tuner panel, and three-valve panel, which are fitted in mahogany canvas-covered cases, with lids and handles for portability. To the left of the tuner panel is a short wave, five-pointed tuning inductance with rotary magnetic reaction coil. This tunes from 100 to 700 meters with .0005 mfd. variable condenser in shunt. To the right is a triple DeForest coil holder, below which is a double-pole throw over series shunt condenser switch. The condenser used is an ex-Military standard of .0015 mfds., which is extremely well made and accurate. A "perikon" crystal stand-by is brought into use by plugging phones in sockets to right of condenser dial and throwing over a switch in the center of the panel.

The valve panel is fitted with ES4 valves for amplifying and Marconi-Osram for detector, both being fitted with separate filament resistances. Sullivan's tapped air-cored transformers are connected to the four-point switches, and these prove very efficient—amplifying on all wave-lengths from 100 meters to 30,000 meters. The "B" battery is fitted in partition to the left of A. T. I. and "REACTION" terminals.

Brown's "A" type phones have proved their sensitiveness and comfort.

Further to the right is the transmitter. With a limited power output of 10 watts, some thought has to be expended on the efficient construction and operation of this instrument. The high tension necessary for the plate is obtained from an ex-Military 30-watt, induction-coil type generator. This gives tonic-train emission, and with a six-volt accumulator and .1 ampere in the aerial at a height of 50′, a consistent range of 50 miles is obtained. Telephony transmissions from Holland, France, and Germany are clearly readable, and conversations on the London-Paris air route are frequently heard.

U. S. high-powered stations such as NSS, WII, WGG, WQK, give good signals throughout the day.

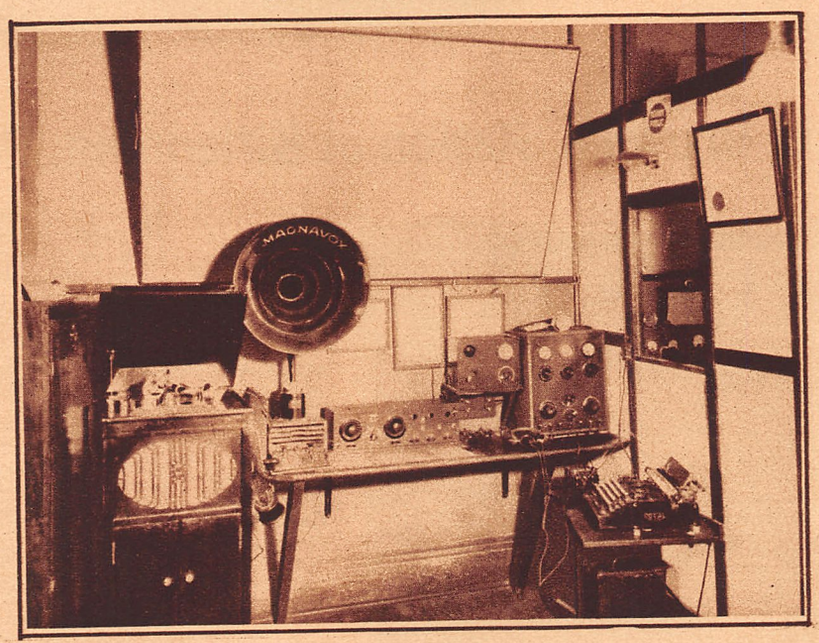
Frank D. Fallain's Station 8AND

at Flint, Michigan

MY antenna is a four-wire, inverted L, 75′ long and 56′ high, with spacing of 2′ between wires. It is located on top of an office building with lead-in of about 30′. Ground connection is made to the water pipes and steam radiator, which works better here than a counterpoise.

Receiving equipment is Grebe CR-9 and for loud-speaker I use the large size of Magnavox.

The transmitter on extreme right is of my own make, using hook-up and data given in RADIO NEWS of June 1920. For phone work I use one 5-watt Radiotron with 360 volts on the plate. Plate current is 100 M. A. This high-current does not cause the tube to become red at any time and can run for hours, only showing red when turned off. Antenna current with above arrangement is .6 amperes. One tube on the



Concerts are Sent out Twice a Week from this Station and Phonograph Records at Other Times. The Transmitter is Entirely Home-Made.

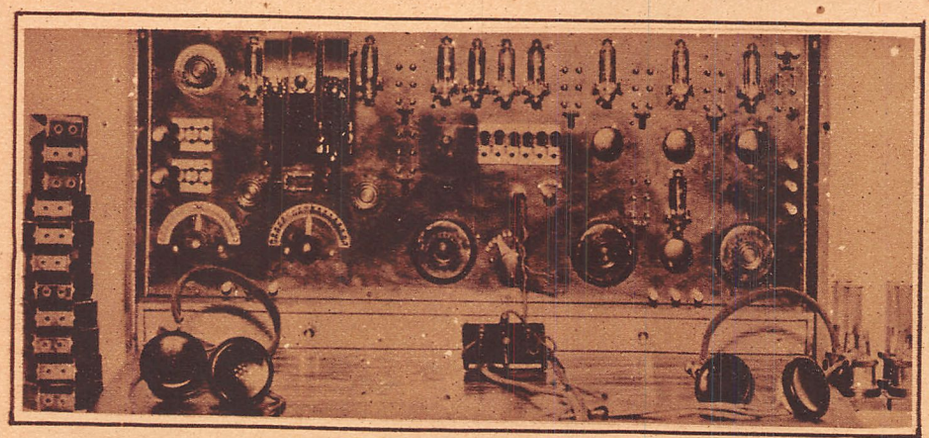
phone seems fine, as I am heard 60 miles away. With only a loop for reception they dance to the music 35 miles away. In addition to the transmission of phonograph records, concerts are put on twice a week by well-known local artists. Modulation is reported as perfect and very clear. For phonograph music I use the Magnavox Tone arm, and a Magnavox hand transmitter is used for speech.

For straight C. W., I use two 5-watt Radiotrons with which an antenna current of about 1 amp. to 1.1 amp. is obtained. Plate voltage 440 D. C. Plate current 160 M. A. While working on .7 amp. I have worked as far East as Bristol, Conn., and Savannah, Georgia, and have been reported as far as Little Rock, Ark., and Pierre, S. D.

The control panel can be seen between transmitter

(*Continued on page* 158)

E. Hannah's Station at Montreal, Canada



Means are Provided in This Well-Designed Receiver to Amplify Any Wave Length at Radio Frequency. Signals from Distant Stations are Copied on a Loop.

HERE is a picture of my combination receiver, which is a six-in-one outfit. In the cabinet are included a four-step resistance coupled amplifier and a three-step transformer coupled radio frequency amplifier, with detector and separate heterodyne. This arrangement enables me to receive, and amplify at high frequency, any wave length. Duo-lateral coils are used for tuning. By means of anticapacity switches, any of the amplifiers may be connected, providing an instantaneous change.

Marconi V-24 Vacuum tubes are used throughout, with a special set of tapped honeycomb coils for long-wave reception. A loop aerial 4 inches square, wound with 90 turns of No. 28 wire, is used in conjunction with this set, most of the time, as reception with the out-door aerial is often difficult.

The complete cabinet, including the "A" and "B" batteries, measures 29"x12"x8", and cost me $512. It was constructed mainly from articles and data found in Radio magazines, and took me two months to build. The farthest record on short waves, with my loop, was the reception of signals from Annapolis, Ind., for about two minutes.

E. HANNAH,
5069 Sherbrooke West,
Montreal, Canada.

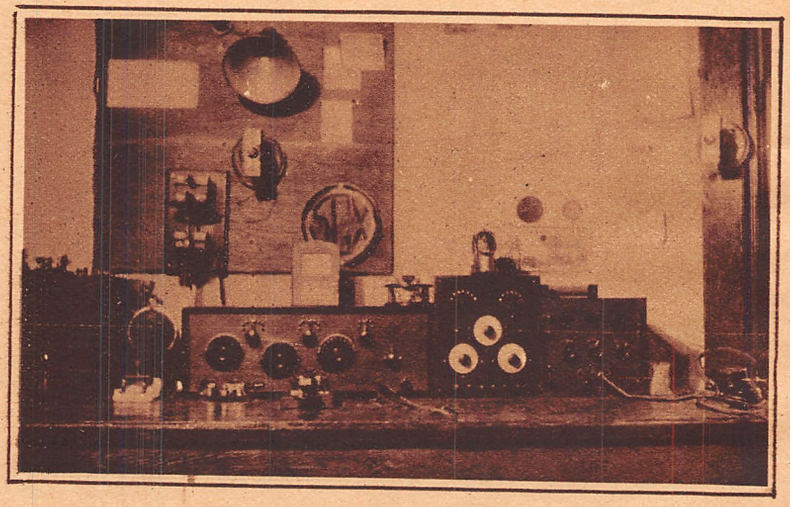
G. Bulger's Station 5CX

At Prince Rupert, Canada

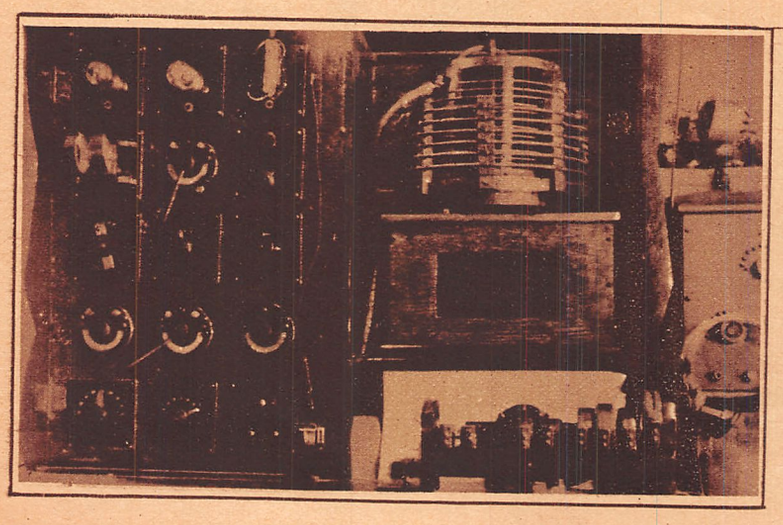
THE attached picture is of my radio set, which I would like you to publish. The aerial is a three-wire, "T" type, 90' long and 60' high. The ground is composed of water pipe, and buried rod and gasoline cans.

The transmitter consists of Murdock rotary, Murdock O. T., Thordarson ¼ K.W. and condenser. Radiation is about 1.1 amperes. The receiver consists of a Duck regenerative receiver and detector, and by means of switches mounted in top of table, I can switch in the Proudfoot Detector and two stages so as to make a three-stage for short waves. For long waves I use a Tresco tuner and the detector and two-stage. There being only two more amateur transmitters in town, I have not much transmitting to do, so my efforts are concentrated in the receiver. The greatest D.X. records of my receivers are 5ZA, Roswell, New Mexico, and 7YG, Y. M. C. A., Portland.

This is Another Canadian Amateur's Station. It Has a Fine Appearance and Gives Good Results.



D. L. Brown's Station at Kittanning, Pa.



Mr. Brown Has a Good Home-Constructed Set. The Unit Panels Are on Hinges and can Swing out at the Front.

BEING interested in your Amateur Department, I thought I would send you a picture of my radio station.

The transmitting set is all home-made except the spark-gap, which is a Sayvill. The transformer is one KW. At the present time the sending outfit is not in use as I have not a suitable aerial for it.

My receiving outfit is of the De Forest Unit type, with panel on hinges so that I can swing it out to make any changes. It is a home constructed outfit. The small panels are made from old storage battery jars. The honeycomb cells are home-made, including the mountings. I have coils to receive from 180 to 20,000 meters. A two-stage amplifier is included in the outfit. I use a loud speaker which I made, with a Baldwin receiver and an old phonograph horn. I get fine results with it. My aerial is about 500' long and 75' high, composed of one single wire (annunciator-wire). The picture explains the general layout. I am

(*Continued on Page* 158)

The Beginning of Wireless Telephony

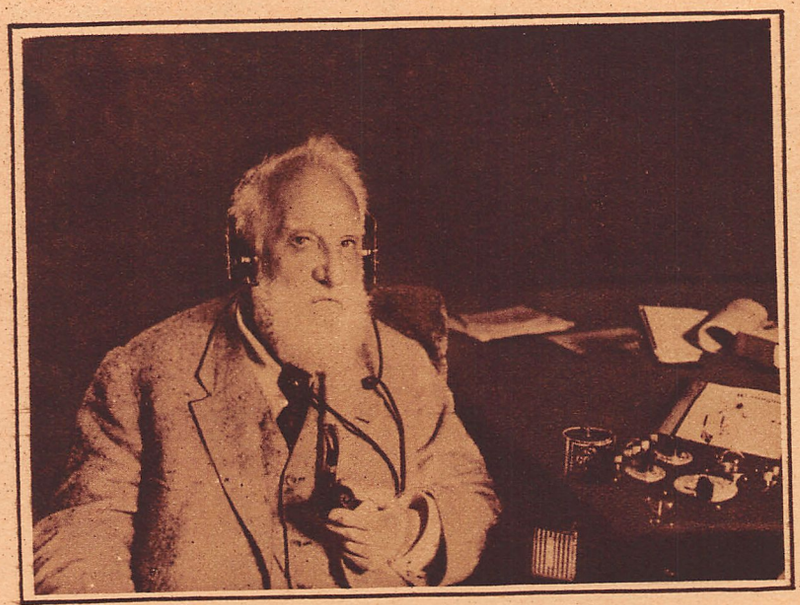
By EUGENE J. DWYER

ALEXANDER GRAHAM BELL, inventor of the telephone, after much study and many experiments succeeded in developing a method by which telephony without wires could be accomplished.

Bell and Tainter constructed the first wireless telephone (not radio) which they called the photophone. Fig. 1 shows a diagram of the apparatus used in the original photophone.

"A" consists of a mica or silvered mirror diaphragm placed over a mouthpiece; "B" is a selenium cell placed in the reflector "E"; "C" is an ordinary telephone receiver connected in series with the batteries "D" and the selenium cell "B."

To work this arrangement the transmitter "A" is fastened at an angle so that the sun's rays can reach the mica diaphragm. The receiver, consisting of "B," "C," "D" and "E," is placed so that the reflected light from "A" can reach the selenium cell "B."



© *U. & U.*
Alexander Graham Bell, Inventor of the Telephone, Listening in to the Radio Concerts

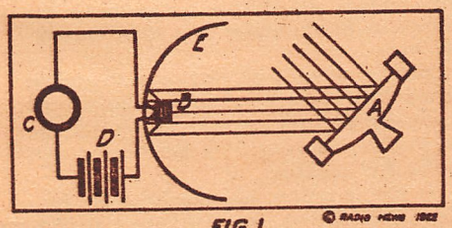


FIG. 1 © RADIO NEWS 1922

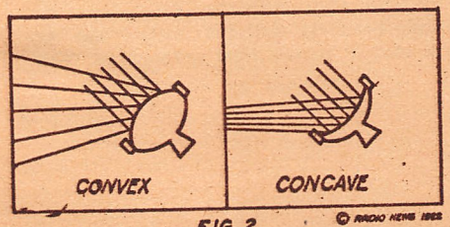


FIG. 2 © RADIO NEWS 1922

Apparatus Used in the Earliest Attempts at Telephony Without Wires

When a person talks into the mouthpiece at "A" the mica diaphragm becomes alternately concave and convex, causing the rays of the sun to rapidly draw together, and then to extend (this is shown more fully in Fig. 2).

When the diaphragm is concave, more light is focused on the selenium cell, lessening its resistance and causing more current to flow through the head phone. When the diaphragm is convex, just the opposite occurs. Thus the light waves are converted into sound waves.

Another arrangement used by Bell and Tainter is shown in Fig. 3.

The sun's rays are reflected by the mirror "M" to the lens "L1," which concentrates them onto the mica diaphragm "D." When a person talks into the mouthpiece "T," the diaphragm becomes alternately concave and convex as described above, sending the light waves through the lens "L2," which renders them again parallel.

With the above apparatus, Bell and Tainter made a great number of experiments, telephoning at one time 213 meters, showing that telephony by light waves was possible for short distances.

Artificial light, such an arc lamp, rendered parallel by a mirror or lens, may be used.

THE THERMOPHONE

Another apparatus used by Bell, called the thermophone and based on the radiation of heat waves, is shown in Fig. 4.

The light from the arc "A" is focused on the silvered mirror diaphragm "D" by the lens "L." When the mouthpiece is spoken into, the diaphragm causes a variation of heat waves to be thrown off, which are focused by the parabolic mirror "M" into the thermophonic tube "T" which consists of a small glass bulb containing a little charred piece of cork. From this glass bulb rubber tubes lead to the ears of the observer.

The variations of the intensity of the heat waves cause similar variations in the volume of the cork, and therefore variations in the air around it. These variations go through the rubber tubes as sound waves.

The apparatus described above was proved by Bell to be capable of transmitting speech a distance of about one hundred meters.

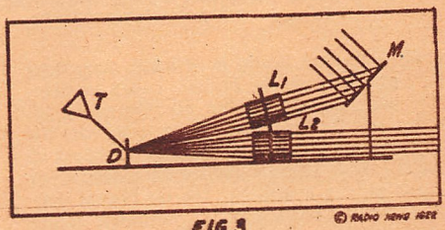


FIG. 3 © RADIO NEWS 1922

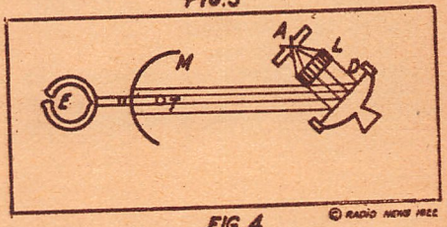


FIG. 4 © RADIO NEWS 1922

Telephony Over Short Distances Was Accomplished in the Early Days by Means of Heat and Light Waves

Radio Music to Moving Train

By L. C. McINTOSH

THE Southern Pacific Railroad Company Creole Special, leaving Los Angeles at 8:35 A. M., April 9, was equipped with a radio receiving set the night before departure and tuned in and tested to the Kinema 50-watt broadcasting station controlled by the Western Radio Supply Company of Los Angeles, Cal. Music from records on the phonograph were clearly audible 1,000 feet to the rear of the open door. The experiment was placed in charge of Radio Engineer V. M. Bitz of the Manual Arts Radio Shop, 4154 So. Vermont Ave., Los Angeles, Cal., assisted by L. C. McIntosh, of the Southern Pacific Telegraph Dept., and special correspondent of the *Telegraph and Telephone Age*, 253 Broadway, New York, and Ray Brainard, Carlighting Dept., Southern Pacific Telegraph Dept., and Angeles, California.

A 40-foot, two-strand antenna was placed 14 inches above the roof of the car. The two strands were tapped at the center of the car and the taps joined inside the car and connected to the receiving instruments.

A special concert for the benefit of the passengers was arranged by Mr. H. P. Monahan, Passenger Agent for the Southern Pacific at Los Angeles, with the Kinema 50-watt broadcasting station, using an antenna surrounded by many tall steel structures.

The receiving set consisted of a two step Magnavox audio frequency Power amplifier. A type R-2 Magnavox Amplifying horn and a Western Electric two step amplifier and detector. 200 volts of "B" battery, six volt filiment battery. Four wires were laid on the cement floor of the car under the carpet and brought to one common terminal at the set.

Fifteen minutes before departure of the train, we picked up the Kinema operator's voice calling our station as follows:

"Messrs. McGinnis, Monahan, Newspaper reporters, Bitz, McIntosh and passengers aboard the Southern Pacific Creole Special, leaving Los Angeles Arcade Station at 8:35 A.M., today and their relatives and friends on platform in rear of car.

"This is the Kinema Theatre Broadcasting Radio Station, located at 642 So. Grand Avenue, Los Angeles, Cal., operated by the Western Radio Supply Co., Los Angeles,

(*Continued on Page* 96)

Dr. Lee de Forest Predicts 20 Million Radio Listeners By 1927

Photo Underwood & Underwood

Doctor Lee de Forest Just Before Leaving for Germany. He Predicts the Increasing Popularity of Radio.

THE day of Radio is at hand, according to Dr. Lee de Forest, radio pioneer, who, before leaving for Germany recently, left a message to be read at the Radio Exposition which was in progress at Boston. The present published estimate of a radio public, a million, Dr. de Forest considers highly conservative; his own figure is that within two years there will be 5,000,000 and by 1927, 20,000,000.

Dr. de Forest's message said:

"Allow me to express my appreciation of the honor conferred upon me through your request for a few words to be included in the public ceremonies attending the opening of the Boston Radio Exposition. Your request is one that, even in the present press of research and experimenting, I am personally unable to refuse, for, as you know, the subject of Radio and Broadcasting, after so many years of what might be called pioneer effort, is too close to my heart to be ignored.

"It is not often the happy lot of a prophet to witness within a few years, or even in his lifetime, a full and sudden fulfillment of his prophecies, made before a world of indifference, a world of skeptics.

"Yet in the world of Radio, our dreams have come true. Like a tidal wave the attitude of press and public, of government officials and trust directorates, toward Radio Telephone Broadcasting, toward the Radio Telephone itself, has mounted within a few months to a magnitude of interest. This rather late though sudden conversion is certainly heart-warming to those who have spent so many years in what appeared, in those early days, to be fruitless effort; for, let it be said that the transmission of the news and music by Radio is in itself by no means new.

"It was in the summer of 1907 that I had the pleasure and the thrill of first sending out music such as that being now daily broadcasted. This was from a little laboratory in which I was at work in the old Parker Building, corner of 19th Street and Fourth Avenue, New York City—upon the topmost floor; from my roof an antenna was stretched between two flag-poles. In that same little old laboratory, many months earlier, I had conceived and tested out the first three-electrode vacuum tube—first with the "Control-Electrode," a simple band of tin-foil wrapped around the outside of the bulb; then, with two plates, one on each side of the filament, one the anode, the other the control; and finally with the third electrode in form of a grid, or a perforated plate located between the filament and anode.

"There, also in that same little upper room, I had the added thrill of discovering that this grid tube, which had just been christened "Audion," would actually amplify telephone currents. In that room there was born the tiny little glass baby which was destined to rule the world of electrical communication,—the modern Aladdin's lamp, the present transmitter of news and music, and of untold happiness to come.

"Unfortunately, in January, 1908, a great fire completely gutted the Parker Building, wiping out of existence note-books and many precious samples, of the earliest Audion bulbs—which would have today shown the history of its revolution in a most interesting way.

"But the memory of that early struggling period still lives; a pleasant memory no doubt, shared today by many who in one way or another contributed to the development of the Art of Radio.

"It was in testing out some 20 small telephone transmitters for installation on Admiral Evans' battle-ships and destroyers prior to their historic round-the-world cruise, however, that the phonograph was first used to actuate their microphone. Dur-

(*Continued on Page* 80)

The Radio Car

ONE of the latest radio developments is the radio car. The Chevrolet Motor Company has proved that radio equipment operates satisfactorily in an automobile without the use of a "ground."

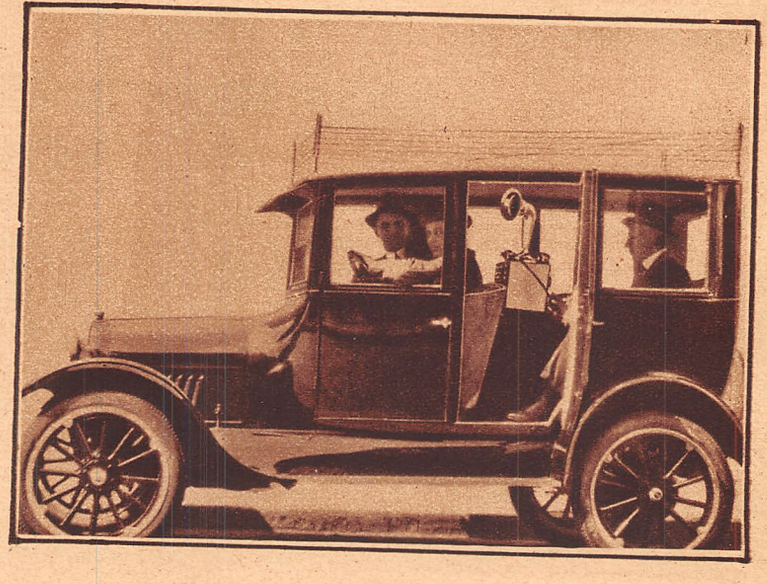
The possibilities that this portable radio receiving station offers include an almost limitless field of use, and with such tremendous strides as these made in its development, it is bound to become one of the indispensable utilities of modern civilization.

With a car equipped in this fashion it is possible for a family to drive anywhere within 100 miles or so of a broadcasting station and picnic while the radio in their car amuses or instructs them with music, sermons, or wireless telegraphy. Education and entertainment can be transported to wherever people congregate. With a few cars equipped as this one, a minister could talk to a dozen congregations at once. If the United States Department of Agriculture had similar radio equipment in the hands of its county agents, department experts could talk to thousands of farmers at once and thus bring the tremendous added benefits to our agriculture that would be made possible through a greater broadcasting of its work.

If the political candidate had a broadcasting station available he could send a radio equipped car to every voting area in his state, and talk to all of his constituents at the same time, thus saving his vocal cords and making it possible for his hearers to stop listening when they become tired.

The installation of this equipment in the Chevrolet car is so simple that it is possible to adapt it to many uses, and, therefore, we may expect to see many cars similarly equipped in the future. It is also only a matter of a few moments to remove the radio equipment from the car when it is not desired for use there. It can then be used in the home or the office, or any other place desired.

(*Continued on Page* 82)



Good reception has been obtained with this receiver mounted in an automobile. Many of these will soon be seen on the streets.

Gunbarrel Radio

By H. M. SUTHERLAND

WE had just ordered dinner at "Beefsteak Henry's" when Dan Collingame entered. There could be no mistake about his identity. It was only necessary to see his arms once and you would recognize them again no matter where you saw them. For twenty years, while chasing moonshiners in the Southern highlands, he had carried a heavy revolver under each armpit. This had necessitated keeping the elbows at a forty-five degree angle from the shoulder. Not only did that relieve the pressure on the guns, but enabled him to get in action a few seconds sooner.

Collingame had a habit of turning up at unexpected moments and in widely divergent fields. Four months previously I had seen him supervising the moving of equipment captured in a counterfeit raid on Houston street just off Seventh avenue. A year before that, I watched him stagger down the main street of a little town in South Carolina with a negro captive chained to his wrist. That negro was "Black Diamond," the most notorious moonshiner and killer in the South, and Collingame, raving in the delirium of fever, dragged his prisoner twelve miles through almost impenetrable swamps to jail.

He was general "clean-up" man in the Internal Revenue department and his duties carried him all over. When department agents ran up against a proposition that was too tough to handle, Dan Collingame and his picked squad were sent into action with the inevitable result. The man had seen more swift action, passed through more hair-raising experiences than befalls the lot of the select few, favored by fortune in the game of man-chasing. He joined us and we prayed that his dinner would be to his liking, for sometimes, after a thoroughly satisfying repast, he would grow talkative, reminiscent. And when he told a story he rarely had any difficulty in holding his hearers, and he never told the same story twice.

With the coffee the conversation drifted around to the development of the radio and the possibility of the wireless telephone. That was a lucky move on our part. Collingame drained his cup and lighted a pipe. Leaning back comfortably he blew a couple of preliminary rings ceilingward and we drew closer.

"You know, the wireless messages are not so new as you think." His voice was slow and drawling, for he came originally from the mountains of Eastern Tennessee. "Those mountaineer clans—moonshiners for the most part—have had a system of wireless messages ever since they chased the Indians out. I'm speaking of the hillsmen of Southern West Virginia and Eastern Kentucky. I've run into that wireless a few times and believe me it's about the most efficient I ever saw." He was silent for a minute, but we didn't dare speak for fear we'd get him out of his story-telling mood.

"For a long time I didn't pay much attention to this radio stuff," he continued. "I figured it was like this spiritualistic, medium dope, all fake. In fact I don't think I ever saw one of the outfits until some of my own men rigged one up. We'd been ordered to a wild section of North Carolina called 'No Business' to clean up a gang of moonshiners who had picked off a couple of special agents. One of my best men was a 'nut' on radio—Al. Lambert was his name.

"Al. showed another of the boys how to send messages on the thing by a special code. The darn thing worked and we had a lot of fun out of it during our stay here and elsewhere, but still I didn't take much stock in it. I figured that it was a good thing to play with when there wasn't any business to attend to, and when we left 'No Business' I forgot all about it.

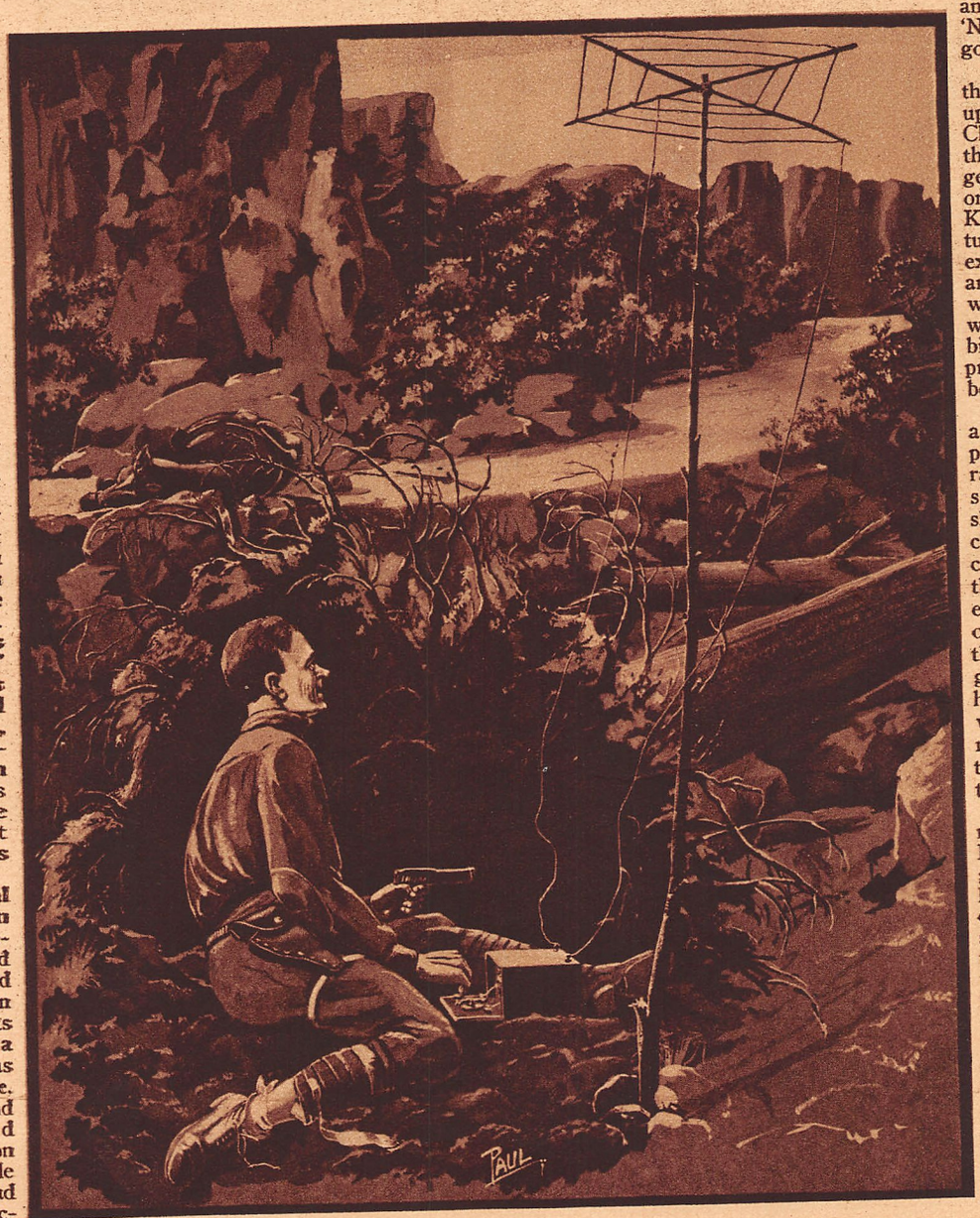
"Not long after that, I got a hurry-up order from the Chief telling me and the boys to go and get the Farley gang on the headwaters of Knox Creek in Kentucky. We'd been expecting that order and we knew before we started that it was going to be the biggest and toughest proposition we'd ever been up against.

"The Farleys were a bad bunch. They placed revenuers and rattlesnakes in the same class. And shoot? I'll bet that clan, man for man, could outshoot all the rifle record holders in the world with one hand tied behind them. The chief gave me fifteen of his best men so that we could work in relays, and I knew that I'd need all of them.

"It was early summer when we hit the Farley's stamping ground. We established regular headquarters in a deserted cabin about ten miles from where we thought the gang was operating. As usual Al. Lambert rigged up his wireless the first thing. He had made a lot of changes in his apparatus and had his wires stretched in a tree top, and his receiving set in the cabin. He was tinkering about the thing almost all the time he wasn't scouting.

"We worked in two squads of eight men each and we combed those hills with a fine-toothed comb. Each day we got a bit further back into the hills and each mile proved rougher and more difficult to search, if such a thing is possible. We were careful to work under cover so that our presence would not be discovered by the Farley clan, for once warned, they would bury their stills, get their alibies all ready and prove conclusively that they never saw a drop of moonshine in their lives. Oh, they were a canny bunch.

(*Continued on Page* 146)



"I Stepped on the Key With the SOS for All It Was Worth. I Didn't Know Enough About the Thing to Be Absolutely Certain It Was Working Right, But It Seemed to Be Acting Like It Always Did. I Cussed Myself for Not Paying More Attention to What Al. Had Told Us About the Insides of the Thing."

"---And It Came to Pass"

A Description of Radio Types and Divers Other Matters.

By S. P. W.

On Meeting Nights He Presideth With Dignity and Misgivings. The Junior Members Findeth Amusement in the Size of His Feet, and Great Joy in Various Other Matters of Personal Appearance. They Rejoiceth Exceedingly When the Chair Wherein the President Sitteth Giveth Way, and They Taketh Delight in Divers Other Matters Which Shall for the Time Remain Undisclosed.

AND it came to pass in the fulness of time that a certain man who dwelt in the land where the Eights and the Nines filleth the ether with their buzzing and their warbling was elected to the post of President of the local Radio Club. It gratified him exceedingly.

He assumeth his duties with joy, he striveth mightily to struggle through an Order of Business. He listeneth with attention to fool ideas, and squelcheth them with tact. He taketh counsel with the wise ones, and enforceth their decisions, even to the establishment of a listening hour, wherein the squeak-boxes restraineth themselves, and the owner of the I. K. V. A. around the corner scratcheth an itching finger in vain.

On meeting nights he presideth with dignity and misgivings. The junior members findeth amusement in the size of his feet, and great joy in various other matters of personal appearance. They rejoiceth exceedingly when the chair wherein the President sitteth giveth way, and they taketh delight in divers other matters which shall for the time remain undisclosed.

Yea, the President suffereth long, yet lo, the means is at hand whereby he shall be revenged, for he hath taken his typewriter unto himself, and he poundeth out his impressions of the types he observeth from the Chair. And those who readeth will take unto themselves a description and say "Lo, he meaneth ME!" and they will be exceedingly angry. But they will know not whom to smite, and the President will go unsmitten. For he is wise, and signeth not his name, which is the part of wisdom!

The types that the President observeth are in this wise, and who shall say that there are not others also?

Dan Darling—the Only Son

He rangeth in age from twelve to eighteen, he weareth fine clothes in the presence of regular "hams." He knoweth too much for his own good; he attempteth to speak in the presence of his superiors of things he knoweth not. He persuadeth his fond and usually wealthy parents to buyeth him high-powered sending apparatus, and lo, he useth it at all hours, and turneth on full power to converse with his friend two blocks away. He getteth angry when he is rebuked, for he reasoneth, Am I not an only child, and is my father not a man of much importance? And he goeth on his way till he groweth up and meeteth the world. The change then either maketh or breaketh him, and it mattereth little which!

William Wiseman

He sitteth always with a look of wisdom upon his face; he smileth to himself with superior wisdom when a paper is being read by some other member; he knoweth all things that are to be known, and he admitteth it himself. He correcteth his fellow-members when they maketh statements that he deemeth incorrect, and he argueth with anyone at the drop of the hat.

Yet withal he maketh a fine member, for he stirreth up things and giveth "pep" unto the meetings of the Club. He maketh his friends careful in their speech, and he is an influence for good—but beware that you have not two such members, for lo, two such members argueth continually, and the Order of Business getteth not past the Report of the Membership Committee.

Parliamentary Procedure Pete

This bird readeth Robert's Rules of Order by the light of his V. T.'s, and he learneth that the President goeth not according to the strict interpretation. He useth phraseology in addressing the Chair whereof the Chair, in its ignorance, knoweth nothing, and he maketh motions whereof the President knoweth not the purport. He createth glee in the heart of the members, and consternation beneath the vest of the President.

He calleth out "Shades of Robert's Rules of Order!" and groaneth unto himself, when the Chair ruleth a motion out of order, or accepteth an amendment to a motion when the amendment should not be accepted. He beareth not with the ignorance of the Chair, but curleth his lip in scorn. Yea, he faileth to realize that it taketh a guiding hand to put through the business; that it frequently becometh necessary to exercise discretionary powers, even unto the point of abandoning the "Rules of Order."

But ye who have served knoweth that it is so, even as has been stated!

Silent Steve

He attendeth every meeting with commendable regularity; he is a fine member in every way except one, which is to say he speaketh not, neither does he offer suggestions. The limit of his vocabulary is "Secon' the motion!" and at rare intervals, upon request, "Move we adjourn!" He hath good ideas, and knoweth much that is practical about radio. He buildeth himself a fine set, and hath a good "fist" and a good idea as to when to exercise it, which is of exceeding importance. He worketh for the good of the club, and holdeth himself ever in readiness to pitch in and help.

If it were only possible to arouseth him, to waketh him up that the club might have the benefit of his knowledge and his good judgment, he would be the ideal member. Let us hope that he will even yet abandon his shyness and blossom out as a speaker, even as he is fitted to do.

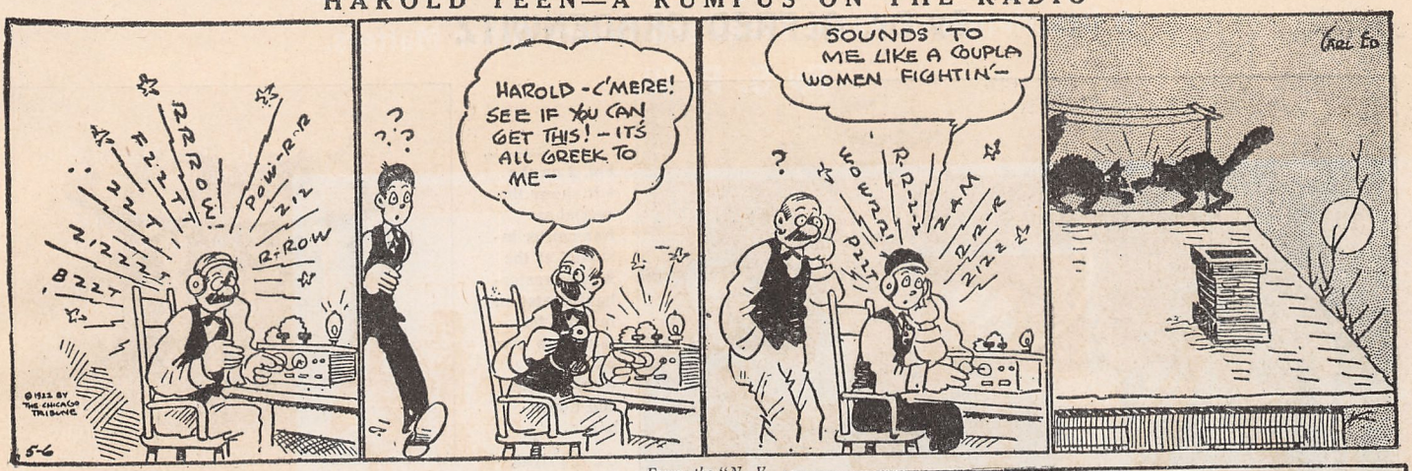
The Kid

Though he is listed last, he cometh first in importance, if numbers are considered. He taketh up the first two rows of seats at Club meetings, he readeth radio magazines during meeting time, and swappeth hook-ups with his brothers. He knoweth a little about radio and thinketh that that little is much. His age mattereth little; sometimes he weareth short trousers, and in other cases he hath

(Continued on page 145)

Radio Humor

HAROLD TEEN—A RUMPUS ON THE RADIO



From the "N. Y. Daily News"

MERRILL SHUDDERS EVERY TIME HE THINKS OF IT

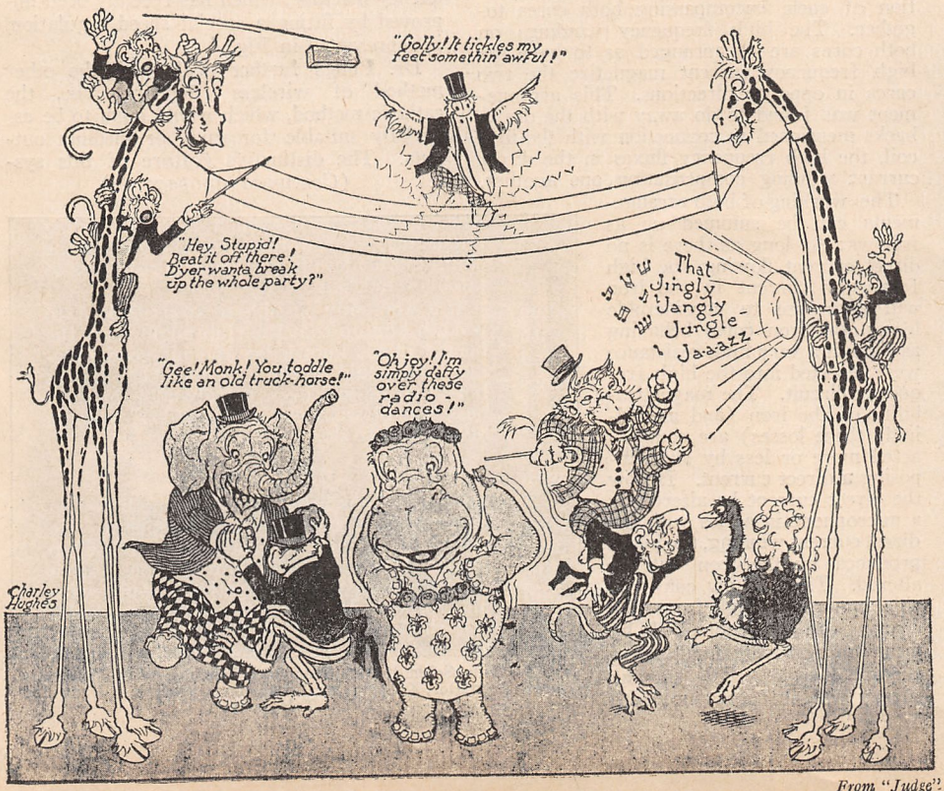
From the "Rockford, Ill., Morning Star"

From "Judge"

A BROADCASTING STATION

The cartoonist above has some ideas of his own on static. Rubbing a piece of amber on hair produces static electricity, so one cat's claw through another cat's fur should produce the same effect, shouldn't it? A little involved, but the idea's there.

"Judge" gives some new designs of broadcasting and receiving stations and below there is a suggestion for a new type of antenna mast if you happen to possess a couple of stray giraffes.



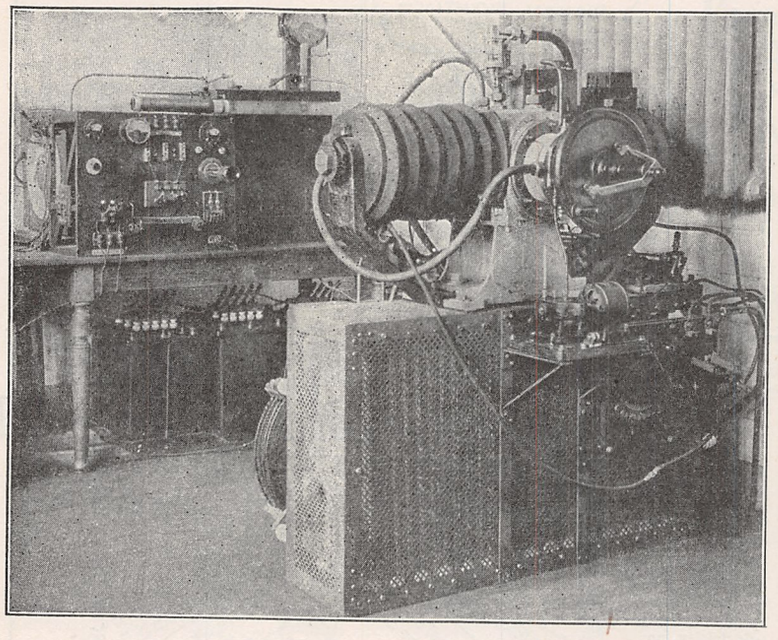
From "Judge"

From "Judge"

A RECEIVING STATION

The Pungs-Gerth System of Wireless Telephony

By Dr. ALFRED GRADENWITZ*



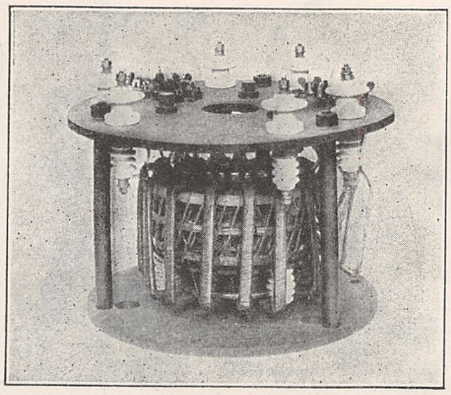


Fig. 3 on the left shows the special arc transmitter installed at the Königswusterhausen station in 1920, for telephone communication with Moscow and Copenhagen.

On the right, Fig. 1 shows the first type of magnetic modulator used with this transmitter.

At a recent meeting of the Berlin Society of Electrical Engineers, Dr. L. Pungs, chief-engineer of Messrs. C. Lorenz, gave an interesting account of recent developments in radio telephony. After a short historical survey he dwelt at some length on the development of undamped oscillations by the Danish engineer, Valdemar Poulsen, whose work first brought wireless telephony within the range of practical possibilities. In fact, the first stations for wireless telephony installed in actual service for the German marine were designed on this system.

With these earliest types of wireless telephone outfits, the microphone, which, the same as in the case of wired telephony, serves to transmit the sound vibrations of human speech to the radiated antenna energy, was connected up immediately to the antenna. Such arrangements, however, could obviously be used only for low-power stations, i. e., over short distances. How should, in fact, a microphone be able to control antenna currents which in the case of up-to-date high-power stations, work out at 30, 50, 100 or more amperes, altering the rhythm of these currents in accordance with the sound vibrations of human speech?

Solutions of this problem, on which the whole recent development of wireless telephony is based, have been found in two different ways. First, by what is called a magnetic control and, second, by means of cathode tubes. Dr. Pungs, as far back as in 1913, took up the wireless telephone problem, at first alone, afterwards in conjunction with Dr. Gerth, trying to devise a magnetic system.

The first magnet coil for acting on wireless senders by means of human speech is represented in Fig. 1 and comprises in its interior a magnetizable horizontal iron ring surrounded by a special winding, through which the high frequency current is thrown. Around this ring there is provided a vertical microphone current (direct current) winding, by which the iron core is saturated more or less, in accordance with the variable current intensity. This coil, however, would give rise in the microphone current winding to extreme high frequency tensions so that defects of insulation were liable to occur. This is why the coil comprising two separated magnetizable iron cores, represented in Fig. 2, was substituted for it. These two cores are arranged horizontally, the high frequency coil being placed on the outer portion of each core, while the direct current winding is placed on the inner portion of each, encompassing both cores together. The high frequency windings on both cores are so arranged as to have the high frequency current magnetize the two cores in opposite directions. This arrangement was found to do away with the drawbacks mentioned in connection with the first coil, the high frequency fluxes in the direct current winding compensating one another.

The working of both arrangements can be summed up as follows: As long as there is no direct current flowing, the high frequency current in the iron will give rise to considerable losses, the iron cores behaving as though a very high resistance were inserted into the high frequency circuit. The magnetizability of the iron (and accordingly these losses) are counteracted more or less by superimposing a direct current. If now the direct current be altered by a microphone in series with the direct current winding, the losses produced by the iron will be altered. This is how considerable amounts of high frequency energy can be controlled by means of relatively small direct current energies. The antenna energy will, in accordance with the size of the station, vary by 10, 20 or even more K. W. in time intervals which, according to the sounds of human speech, may be fractions of 1/1000 second. Whenever even higher amounts of energy are to be controlled, the microphone current is reinforced by a special amplifier. Attention should be drawn to the fact that this arrangement will, with perfect faithfulness render even the most delicate shades of speech, its timbre, etc.

This system, developed by Pungs and Gerth, in conjunction with a Lorenz-Poulsen Arc Sender, was in 1920 first used with excellent results for radio telephony communication between Königswusterhausen (near Berlin) and Moscow, over a distance of 1,700 kilometers, further in connection with mutual wireless telephone tests between the Berlin and Copenhagen city telephone systems (Fig. 3) and, finally, for the wireless transmission of opera performances in the summer of 1921. The outfit has now been in continual operation for nearly three years in Königswusterhausen, in connection with the Poulsen sender installed there, without any hitch ever occurring. Moreover. it affords the very material advantage of being suited for any undamped system. In fact, the same radio telephone system has been used with excellent results in connection with a Schmidt high frequency machine, for wireless telephone tests. This high frequency machine, which has recently been improved by fitting a special speed regulation, is represented in Fig. 4.

Dr. Pungs further dealt with the other method of wireless telephone, viz., the cathode method, which would seem to be especially suitable for small or medium outputs. The distinctive feature of this sys-

(*Continued on page* 74)

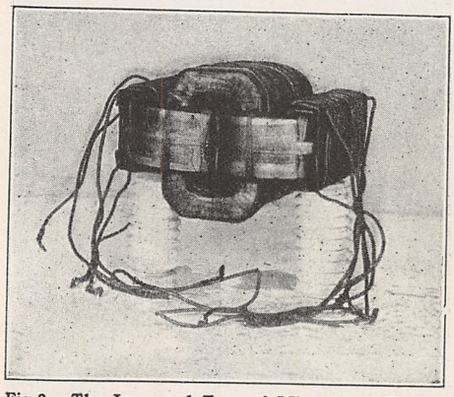


Fig 2. The Improved Type of Microphone Transformer Actually in Use Comprises a Closed Core With the Primary in Two Sections.

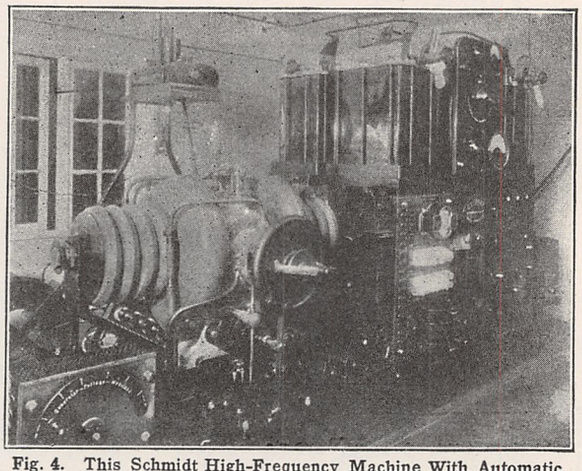


Fig. 4. This Schmidt High-Frequency Machine With Automatic Speed Regulator, Keeping the Frequency Constant, is Used For Radio Telephony.

*Berlin correspondent of Radio News.

A Relay Recorder for Remote Control by Radio

By F. W. DUNMORE*

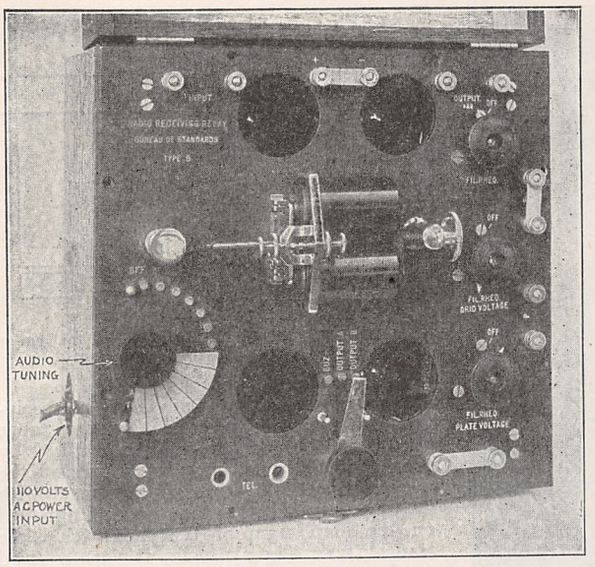


Fig. 6. Type B Relay Recorder for Use on the 110-Volt A. C. Supply

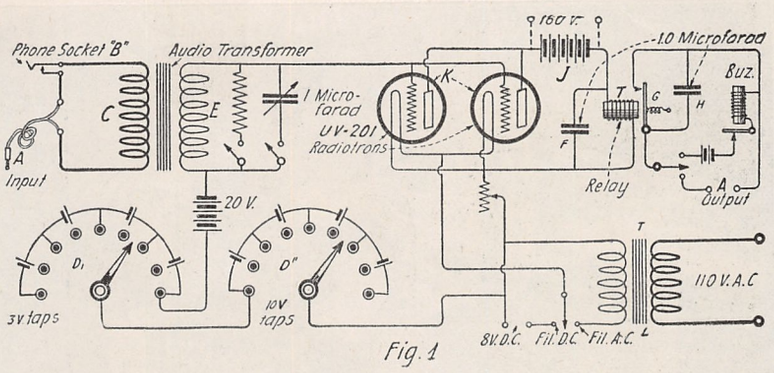


Fig. 1. Circuit Diagram of the Relay Recorder for Use with a D. C. Source

Type A—For Use With Batteries

1. *Object of Development.*—The object of this investigation was to develop a relay which should operate by received radio signals.

2. *Requirements.* To be satisfactory as a relay recorder the device should have the following characteristics: (1) it must be of simple construction with few adjustments; (2) it must be easy to adjust and capable of being put into operation quickly; (3) it must be selective and as free from static and such disturbances as possible; (4) it must be capable of operating at a speed of at least 12 times per second; (5) it must respond to weak signals; (6) it must be of strong design, durable and capable of maintaining its adjustments; (7) it must be portable.

3. *Circuit Used.* In order to avoid the use of a very sensitive relay designed to operate on currents of a milliampere or less, with delicate adjustments and light contacts and spring tension, advantage was taken of the radio-audio amplifier (which has now become a reliable radio instrument) to increase the input voltage to the relay circuit, thus making possible the use of a simple ordinary high-resistance telegraph relay. The relay device has therefore been developed to operate from the output circuit of any suitable amplifier in place of the ordinary telephone receivers.

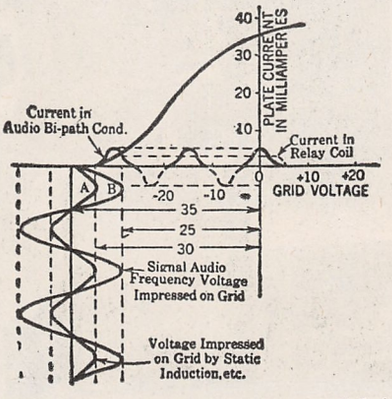


Fig. 3. Method of Eliminating Static and Induction Noises, Which are Not Stronger Than the Signal

* *Radio Laboratory, Bureau of Standards*

The only adjustment necessary is that of an ordinary telegraph relay.

Fig. 1 shows the wiring diagram. *A* is a telephone plug for connecting the relay device to the amplifier output. *B* is a phone socket, so that if desired the operator may listen to the received signal in the ordinary way. *C* is an audio transformer of the type used in audio amplifiers, the type used at present being a Signal Corps Type C-21. *E* is a two-megohm, grid leak. *Q* is a 0.0006-microfarad variable condenser or 0.0003-microfarad fixed condenser. *D* is a 60-volt variable "C" battery variable in steps of approximately three volts. *J* is a 160-volt dry "B" battery self-contained within the set. *K* is a type *UV*-201 Radiotron. *F* and *H* are each a one-microfarad paper condenser. *T* is an ordinary telegraph relay rewound with 12,000 turns of number 38 S. S. C. enamel wire. *A'* is the output to be connected to the apparatus to be controlled. *L* is a step-down transformer for operating the tube filaments from the 110-volt a-c. supply when such a supply is available.

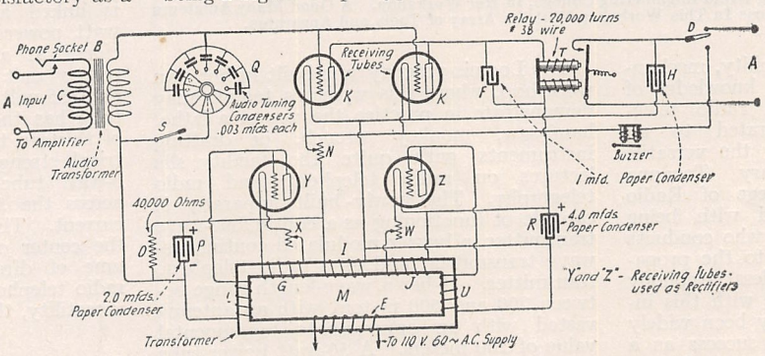


Fig. 5. Hook-up of Relay Recorder for Use On the 110-Volt A. C. Supply

4. *Principle of Operation.* The principle of operation is illustrated in Fig. 2. By means of the variable "C" battery *D*, the grid voltage is adjusted to approximately 30 volts at which value the plate current is zero, as shown at *A*. The incoming audio-frequency voltage impressed on the grid varies the grid potential, for example, from −30 to −20 volts. The 10 volts decrease from −30 to −20 causes an increase, for example, from 0 to 10 milliamperes, while the increase from −30 to −40 volts is not effective in causing a plate current to flow due to the fact that −30 volts is already sufficient to reduce the plate current to zero. The result will be a pulsating direct current of 10 milliamperes, maximum amplitude, in the plate circuit. This current, flowing through the plate circuit and condenser *F* causes an increase in the plate current at the keying frequency, which change, passing through the relay coil, will pull the relay armature over, making contact at *T*, which contact may control any mechanism desired. With the "C" battery grid voltage adjusted for maximum sensitivity it was found that static induction, etc., operated the relay. When these disturbances are not as strong as the signal their effect on the relay may be overcome as shown in Fig. 3. For example, the "C" battery is shown increased to −35 volts, the critical value for maximum sensitivity being −30 volts. The disturbances due to stray currents, etc., merely reduce the "C" battery voltage to −30, which is not sufficient to cause plate current to flow. However, the signal, being of greater intensity than the stray currents, reduces the voltage to −25, which causes a plate current of five milliamperes. It will be seen therefore that all disturbing effects, if of less intensity than the signal, do not affect the relay.

5. *Method of Increasing Sensitivity and Selectivity.* During the development of this relay it was found that the rectified audio-

(*Continued on page* 98)

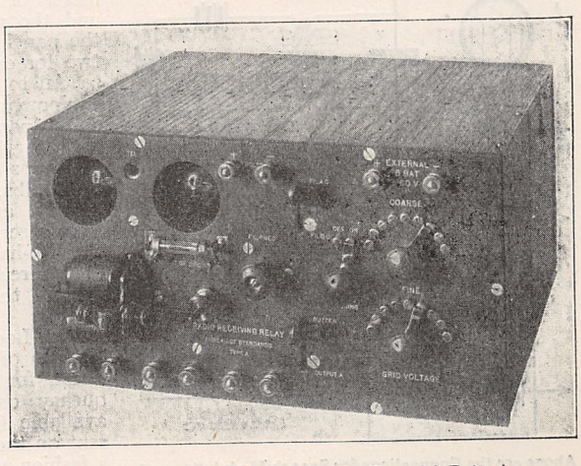


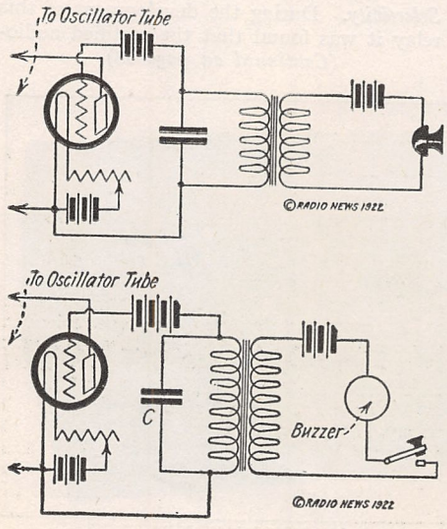
Fig. 4. Type A Relay Recorder for Use with Batteries

A Lady (Radio) Bug

By S. R. WINTERS

Miss Mary T. Loomis, Principal of a Radio Engineering College, In Her Workshop. A Good Many Amateurs Would Like to Be Let Loose In This Workshop With Its Array of Tools and Apparatus.

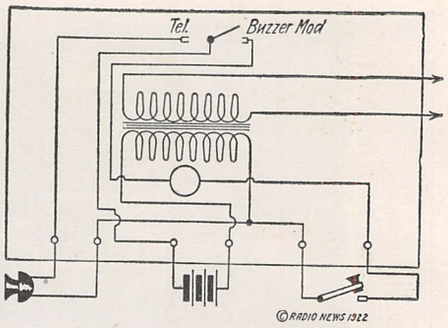
ADMINISTRATIVE ability, mechanical ingenuity, and a knowledge of radio telephony and radio telegraphy are demonstrated to an uncommon degree by the versatile achievements of Miss Mary Texanna Loomis, principal of a College of Radio Engineering. She is credited with being the only woman in the world who conducts a school of learning devoted to the propagation of the science of wireless telephony and telegraphy. Her identity with this institution, however, has already been widely heralded in the press and her success as a teacher of radio engineering is made known from the housetops by students having the privilege of her tutelage. These accomplishments alone entitle Miss Loomis to well-earned recognition, but her latest triumph is likely to add luster to the laurels already achieved. She has lately invaded the realm of invention and designed a radio telephone transmitter.



Above are the Connections for Speech Modulation and Below, the Connections for Buzzer Modulated C. W.

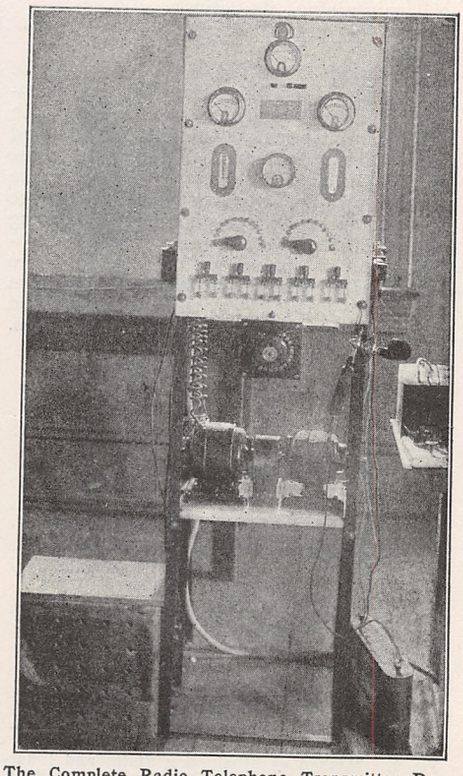
The Loomis progeny was built in her own workshop, where this woman's talents may demonstrate in practice the use of a lathe, hand-saw, monkey wrench, or drafting instruments with quite the facility she lectures on radio telephony and radio telegraphy. The newly-built apparatus is capable of functioning as a continuous-wave transmitter, a buzzer modulated continuous-wave transmitter, and as a radio telephone transmitter. It has a wave-length range between 200 and 600 meters, with an antenna vested with an approximate fundamental value of 200 meters. A 50-watt power tube generates the continuous oscillations, while a 5-watt unit of power acts as a modulator. The outfit is mounted on a marble panel. One hundred and ten volts of direct current is the source of electrical supply, the generator affording from 750 to 850 volts. The motor-generator is mounted on a marble shelf, and the field rheostat for the generator is agreeably situated at the center of the bottom of the panel. The face of the latter is a base for containing the row of control switches, the rheostat handles, contacts for the filaments of the bulbs, a voltmeter for each filament, a current ammeter, and the radiation ammeter. The back of the panel is a resting place for the fuses—two for each circuit—and various units essential to the operation of this transmitting equipment. Accommodation on the back of the panel for containing these units consists of three shelves. The resistance for the bulbs are placed on the lower shelf, and the bulbs, grid leak resistance, the condensers, and a radio-frequency choke coil, have reservations on the second shelf. On the left-hand side of the lower shelf is the filter circuit panel, and on the right-hand side of the lower shelf is the modulating panel.

The Loomis radio telephone transmitter consists of an antenna circuit with a provision for generating continuous high frequency oscillations. Likewise, means are available for superimposing the voice current on these continuous oscillations in such a fashion as to vary their amplitude. These modulated movements to and fro are garnered out of space by any distant receiving radio telephone set within the range of 200 and 600 meters. When rectified by use of a detector, the diaphragm of the receiving outfit is operated in unison with the spoken word or speech waves impressed on the diaphragm of the radio telephone transmitter. The plate circuit when coupled to the grid circuit through the inductance creates a high-frequency current in the antenna circuit.

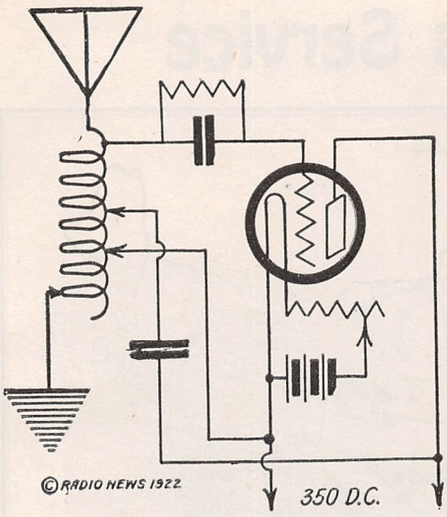


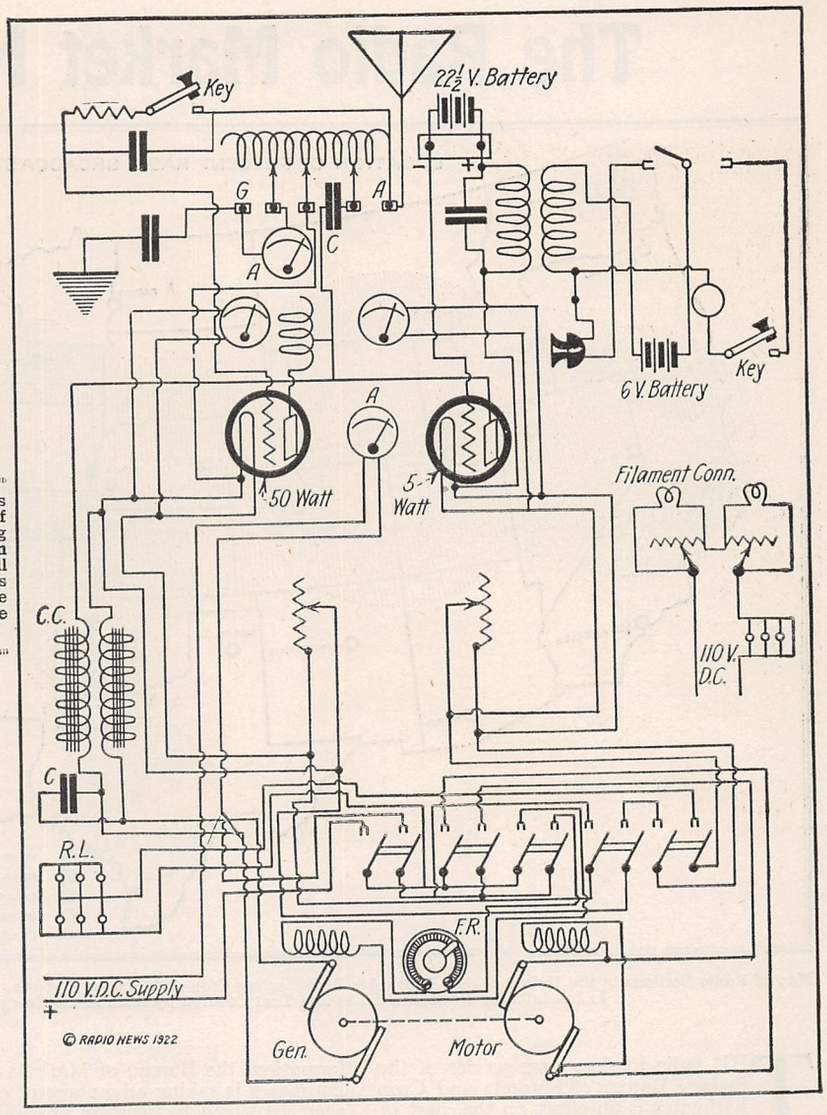
A Single Pole D. T. Switch Is Provided to Change from Voice to Buzzer Modulation.

The connections of the filaments are made by the following specific instructions of this woman inventor, who personally drafted the plan of set-up for the 50-watt radio telephone transmitter. A voltmeter is linked across each filament. The 50-watt power tube operates at greatest efficiency at a 10-volt drop and the 5-watt power unit functions to best advantage at a 55-volt drop. The resistance for each tube has the proverbially unlucky number of thirteen taps. The 50-watt unit of electrical strength draws 5 amperes, and the 5-watt tube 1.2 amperes. The resistance across the 5-watt unit bi-passes the extra current. The direct-current ammeter in the center of the board registers the volume of direct current employed by this radio telephone transmitter. Suggesting its versatility, this ammeter can also be used in



The Complete Radio Telephone Transmitter Designed and Constructed by Miss Loomis.





On the Left is the hook-up of the oscillating circuit and on the Right all the connections of the complete transmitter are shown.

the capacity of measuring the current of each bulb on the motor or the generator field by throwing in the main switch. This is possible when only the piece of apparatus subject to the needs of the moment is in operation.

Instructions for the actual operation of this new radio telephone device are quite as specific as those governing the connection of the filaments. Once the transmitter is in tune, be sure that all the electric switches are open and in receptive mood. The proper fuses are inserted in clips on the back of the transmitting outfit; bulbs are installed in sockets and the resistance lamps are connected; the grid battery and modulator battery are connected, and the buzzer modulating key from intimate association with the transmitter. Having established beyond a doubt that the lever or the continuous-waves key is closed, its proper connection is then effected. The bulb rheostats are shoved completely over to the left position.

(*Continued on page* 82)

Now the Farm Radio Club

By J. FARRELL

TO reach by radio the largest possible number of the 32,000,000 people in rural sections of the country with daily agricultural and general news, it is now proposed to organize farm boys and girls into radio clubs. This is the first organized attempt at a nation-wide radio news service. The United States Department of Agriculture is back of the movement.

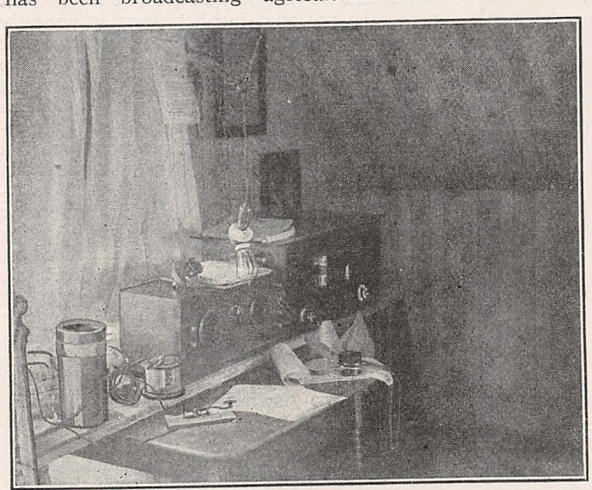
For more than a year the Department has been broadcasting agricultural news from stations of the Post Office Department in various sections of the country. A number of amateur operators receive the reports and pass them on to farmers in their locality. But there has been no organized method of reception and the number of farmers served is small as compared with the total number of farmers in the United States.

A number of farm radio clubs are already in existence, and it is hoped eventually to have at least one club in every county in the United States where radio reports can be received. Farm radio clubs will be plentiful and not only will they render a regular daily news service, but through them the practicability of radio on the farm will be demonstrated. A radio receiving set in every farm home will be the inevitable result.

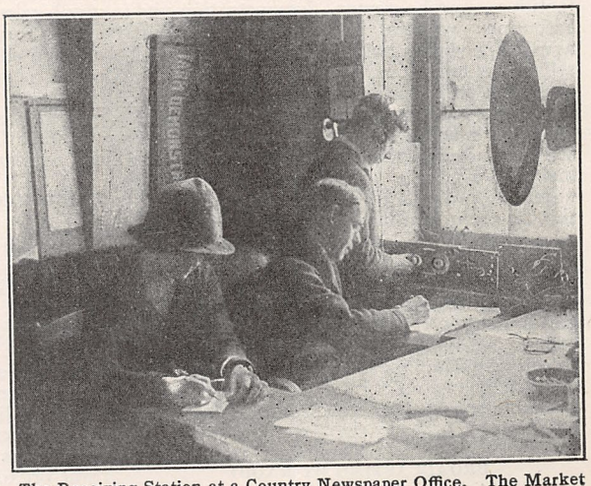
Coöperation in the organization of such clubs is being had with State agricultural colleges and other local agencies. Agricultural colleges which have broadcasting stations are particularly interested in the movement, and in several instances have employed radio experts to instruct the farm boys and girls in radio and to assist in the selection and installation of equipment. Instructions have also gone out to county agents with regard to methods of organizing and conducting radio club work.

The first club of the kind to be organized is the Ocean County Wireless Club at Toms River, New Jersey. The club has 56

(*Continued on page* 90)

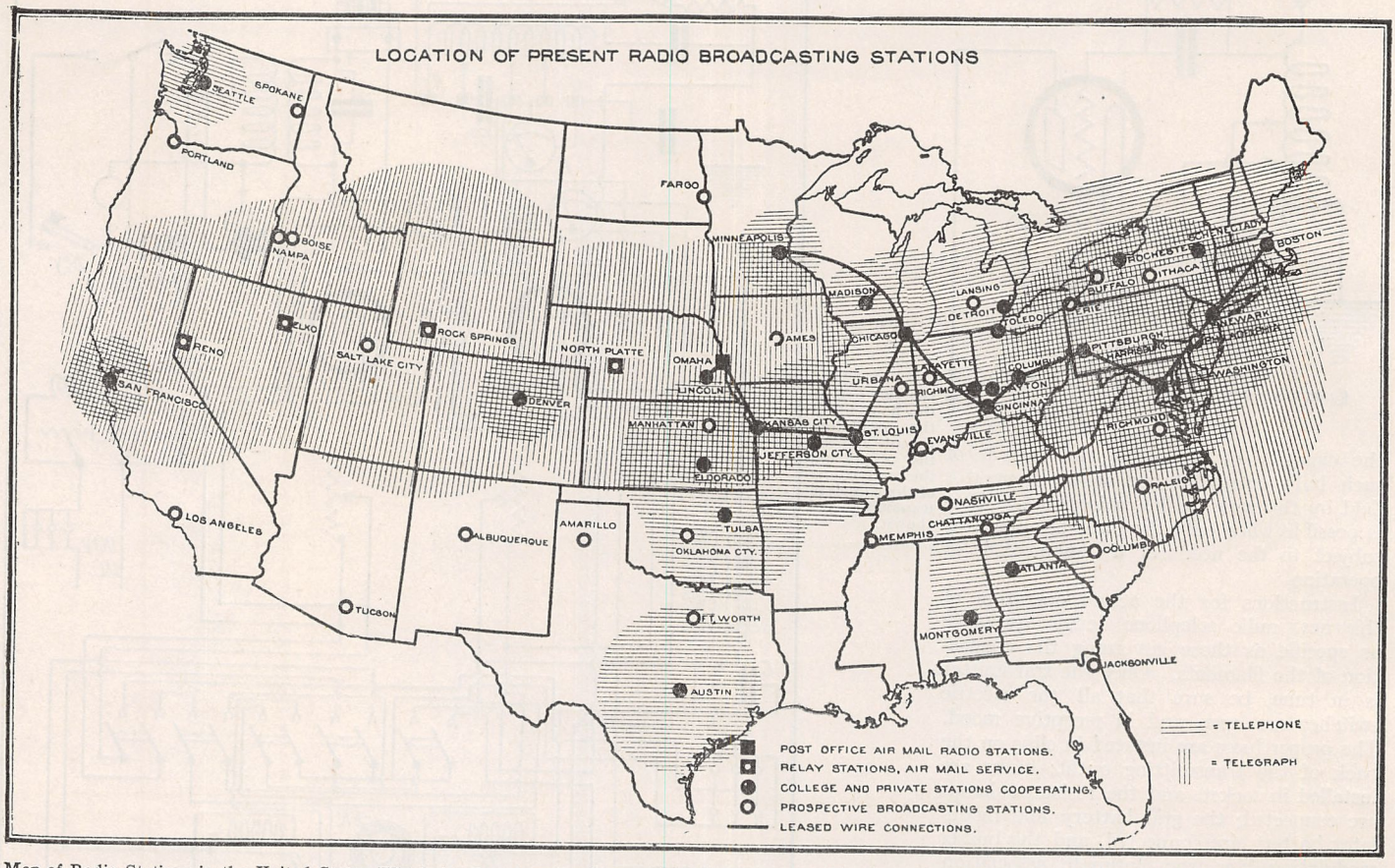


The Market Reports are Received by this Amateur's Station and Re-transmitted by Him for the Benefit of the Farmers in the Neighborhood Who Only Possess Small Crystal Receivers.



The Receiving Station at a Country Newspaper Office. The Market Reports are Received Directly by Radio and Published in the Paper.

The Radio Market News Service



Map of Radio Stations in the United States Which Are Broadcasting Crop and Market Reports. The Approximate Area Covered by Each Radio Telephone Station Is Indicated by Horizontal Lines and That Covered by Each Radio Telegraph Station Is Indicated by Vertical Lines.

THE radio market news service of the Federal Bureau of Markets and Crop Estimates is an effort on the part of the Bureau to make its market news more immediately available and more effective than it can be made in any other way. Ever since the inauguration of the first market news service on fruits and vegetables in May, 1915, the specialists of the Bureau have given continuous study to the problem of supplying market news on agricultural commodities to those who may have use for such information as quickly as possible after it can be obtained. The market news services of the Bureau cover live stock and meats; dairy and poultry products; fruits and vegetables; hay, feed and seeds, and some other commodities associated with these four general groups. The information is supplied to and is utilized by producers, shippers, dealers, brokers and commission men, manufacturers, warehousemen, demonstration and extension workers, banks, transportation agencies, chambers of commerce, buying and selling organizations, and other commercial, extension and educational agencies.

It is the function of the Bureau to gather or assemble market information from reliable sources and distribute it in such a way as to make it available to the greatest possible number who wish to use it. In performing this function it utilizes and cooperates with all agencies possible. It affiliates with State agencies which may or may not have similar functions with respect to the State as the Federal Bureau of Markets and Crop Estimates has to the Federal Government. It utilizes the railroads for information relative to shipments and movements. In one way or another, it assembles information from every available source where such information can be obtained.

BROADCASTING BY RADIO

In utilizing radio communication as a means of disseminating crop and market information, the Bureau of Markets and Crop Estimates is taking advantage of one of the agencies which has certain possibilities possessed by none that has been used in the past. This new method makes it possible for all who wish this information to help themselves to it, if they will but equip themselves to receive it in the form in which it is sent. The advantages of broadcasting information by radio are: (1) that the information can be intercepted or copied by means of suitable equipment at any point within certain approximate limits whether or not such point is connected by railroad, telegraph or any other of the ordinary means of communication; and (2) that the transmission of the news is instantaneous.

These two factors in radio communication make it possible for any one, whether he is located in a congested city or in the country a hundred miles from the railroad or telegraph wire to receive the information with equal dispatch. Radio transmission can be effected either by the international telegraph code, using dots and dashes, or by radio telephone. The radio telephone has the greater possible range of usefulness and will probably become almost as widely used as the ordinary telephone or the phonograph.

RADIO RECEPTION OF CROP AND MARKET REPORTS

Crop and market reports sent out broadcast by radio can be received by any agency having suitable equipment. With the development of broadcasting by radiophone there has developed a demand for receiving equipment from many sources. Not much greater technical knowledge is required to receive the reports by radiophone than to use an ordinary telephone.

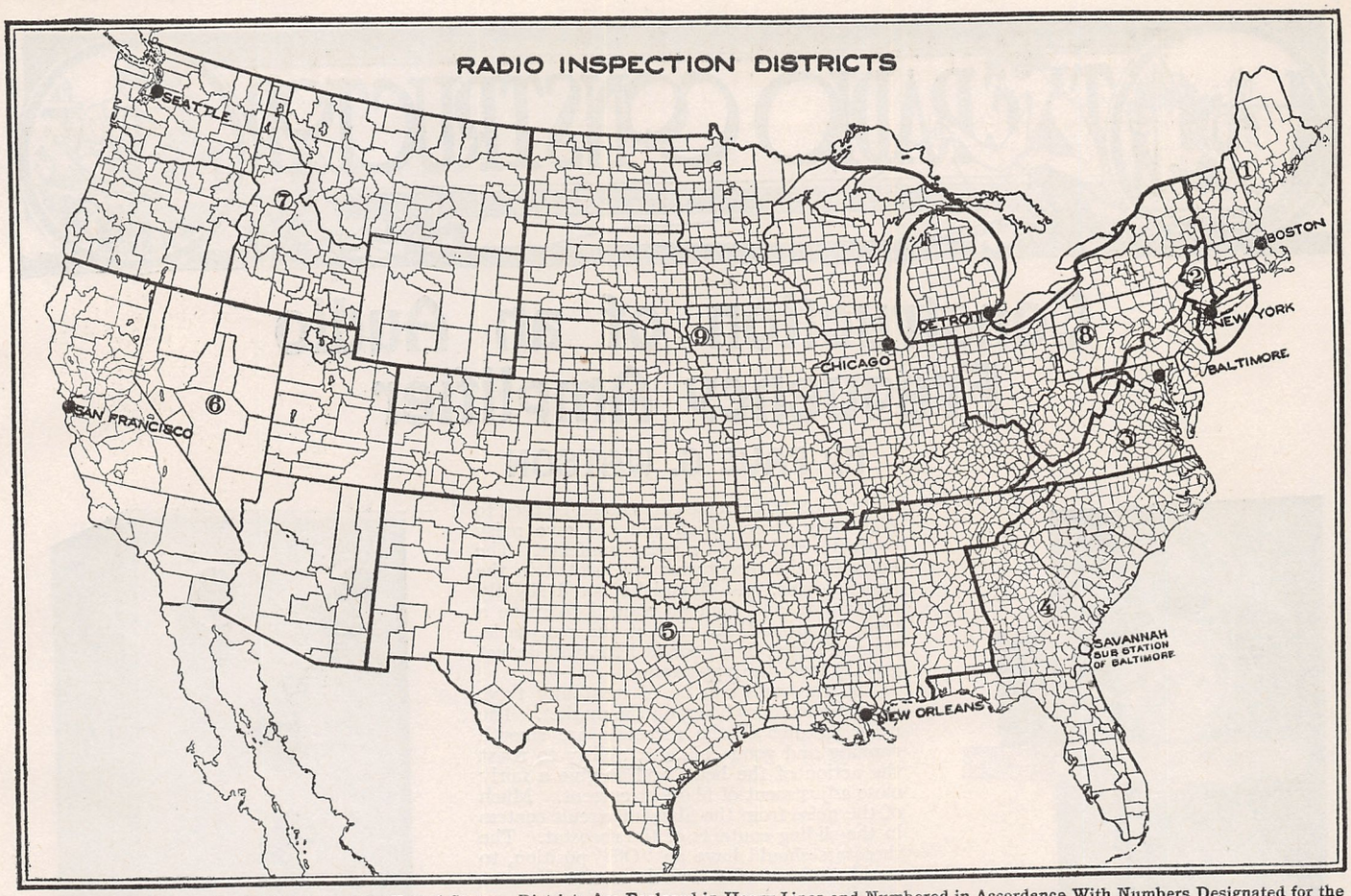
The broadcasted reports are being utilized by various marketing agencies and agricultural organizations in giving to farmers national crop and market reports which are often combined with local market information. These agencies and associations act as centers for information for the county or locality and include farm bureaus, banks, shipping associations, commercial exchanges, chambers of commerce and newspapers. In addition to these agencies the reports are being received direct by farmers, country elevators, dealers, shippers and many others who use the information in the conduct of their business. In some instances it may be to the advantage of the community or to individuals or an organization to enlist the aid of a local radio amateur to get the news and the weather, crop and market reports.

STAGES OF DEVELOPMENT OF THE RADIO MARKET NEWS SERVICE

Since the radio market news service was begun experimentally by the Federal Bureau of Markets, on December 15, 1920, it has developed very rapidly so that, at the present time, the national market news is not only being distributed by the Bureau but other agencies are extending the distribution ot the national crop and market reports as well as local market reports. The service was begun in December, 1920, at Washington. One report was sent out at 5:00 p. m. each day from the station of the Bureau of Standards through the cooperation of the U. S. Department of Commerce. This was continued for four months to determine the practicability of the method. When it became apparent that this method would not only be practical, but also more economical and efficient for certain kinds of distribution than any other agency, the Bureau of Markets accepted the offer of the Post Office Department to utilize the radio stations of the Air Mail Radio Service in the dissemination of crop and market reports.

At the present time the Air Mail Radio Service is broadcasting the crop and market reports from six of its stations. Of these six stations two of them, Washington, D. C.,

(*Continued on page* 108)



Map Shows the Various Radio Districts of the United States. Districts Are Enclosed in Heavy Lines and Numbered in Accordance With Numbers Designated for the Districts by the Department of Commerce. The Cities Are Shown at Which the Chief Radio Inspectors of the Districts Are Located.

The Benefits of the Radio Telephone in Rural Communities

"OBVIOUSLY, if broadcasting is to be developed and the interests of agriculture served, some of the bands in the wave spectrum that have formerly been occupied by marine, aerial, and other kinds of communication must eventually be transferred to broadcasting," asserts W. A. Wheeler, in charge of the radio news service of the United States Department of Agriculture in an interview for RADIO NEWS. He has taken up the cudgels in behalf of an enlarged recognition of the interests of the countryside through a more liberal assignment of operating wavelengths and consequently a wider application of radio telephony.

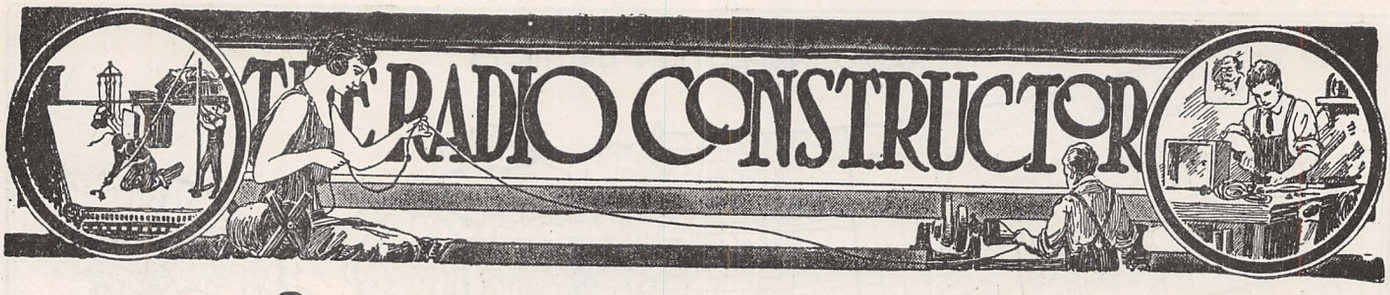
"These assignments," referring to the allocation of wave-lengths as recommended by the conclusions of the radio telephone conference recently held in Washington, "do not appear to be nearly adequate for the proper development and expansion of public radio broadcasting in the interior of the country in the near future," declares Mr. Wheeler. He represented the Department of Agriculture at the conference called by Secretary of Commerce Herbert C. Hoover, at the request of President Harding, to consider the regulations and uses of radio telephony. His discordant note, with respect to the deliberations of this conference, which are in the form of tentative recommendations, is likely to be echoed throughout the rural communities of the United States where the benefits of radio telephony are beginning to rob farm life of its isolation and monotony. Mr. Wheeler told the writer that long after the city-dweller has discarded his wireless equipment, when the novelty of operation has faded, the farmers of America will be operating radio telephones with zest and in increasing numbers.

Secretary of Agriculture Henry C. Wallace, apparently, is of the same opinion as to the vast benefits accruing to rural communities from the application of radio telephony. In the first message ever delivered by a Secretary of Agriculture, through the agency of the radio telephone, to a group of farmers located a thousand miles away, Secretary Wallace stated: "That this can be done successfully gives promise of what we may expect in the future. It will not be long until individual farmers everywhere can install receiving sets at small expense and get frequent daily reports from the principal grain and live stock markets, weather forecasts, and important news." This message was spoken by Secretary of Agriculture Wallace at his home in Washington, D. C., to 4,000 farmers gathered in a convention at Lansing, Michigan. The deliverance was transmitted by the Naval Air Service and many other groups of farmers and individuals in the Middle West heard the speech by radio telephone. The Secretary of Agriculture has recently had installed in his home a radio telephone.

Miss Ruth Wallace, Youngest Daughter of Secretary of Agriculture and Mrs. Henry C. Wallace, at the Receiving Set in Their Home. Secretary Wallace Is Confident of the Utility of Radio for the Farmer.

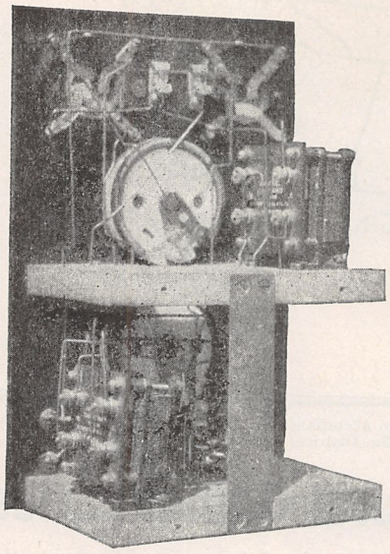
"There is no single use of radio, except for marine and aerial purposes, that should take precedence over its utilization for the benefit of agriculture," continues W. A. Wheeler. "There are more than 32,000,000 people on farms, comprising nearly one-third the total population of the United States. Most of these people are located where they are practically cut off from immediate contact with the outside world. The radio is the only means of getting to them quickly, at small cost, the economic information necessary in the proper conduct of their business." A movement being

(*Continued on page* 120)



Construction of an Audio Frequency Amplifier

By PAUL G. WATSON



Rear View of the Amplifier Showing How the Various Pieces of Apparatus are Assembled and Mounted.

THE details for constructing a two-step audio frequency amplifier follow: The original, shown in the photographs, was made from standard parts, available in any radio supply store, and involves no difficult construction work. The original has the appearance of the old type "De Forest" amplifier, but differs electrically from that piece of apparatus in many ways.

This instrument is an audio frequency amplifier; that is, it amplifies only the signals picked up by the detector. To secure further amplification of signals, it is necessary to amplify the incoming signals before reaching the detector. This system is known as "Radio Frequency" amplification and involves more complicated construction work. The audio frequency amplifier is the one in common use today, and for all practical use is sufficient for most cases. An amplifier of this type is used to make the radio broadcast music loud in most all stations where signals of any volume are received at present.

The dimensions of the instrument are large, much larger than many of the newer types of amplifiers, the panel being 7½"x11½". It was found by experimentation that the large panel was justified by the quietness of the amplifier, compared to the same apparatus mounted on the smaller panel. Many of the howling and grinding noises come from over condensing the amplifier parts.

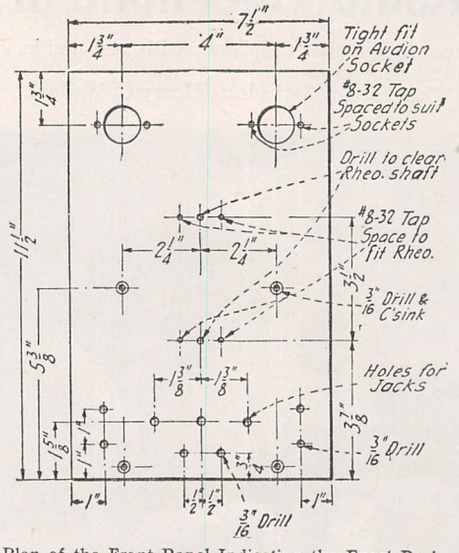
A great many of the construction details can be taken directly from the photos of the apparatus. A detail drawing, giving the spacing and dimensions of the panel, is shown, also a diagram of connections.

The receptacles or sockets for holding the tubes are mounted by 8–32 machine screws, run into the tapped holes at the side of the large socket hole. In selecting sockets, jacks and rheostats, extreme care should be used to pick only those which will not give noisy contacts, and create a noisy amplifier. The holes for the receptacles are located in the panel details, and should be bored slightly under size, and filed or reamed to make a snug fit around the side of the receptacle. Ragged edges, or a poor fit here, will deduct greatly from the appearance.

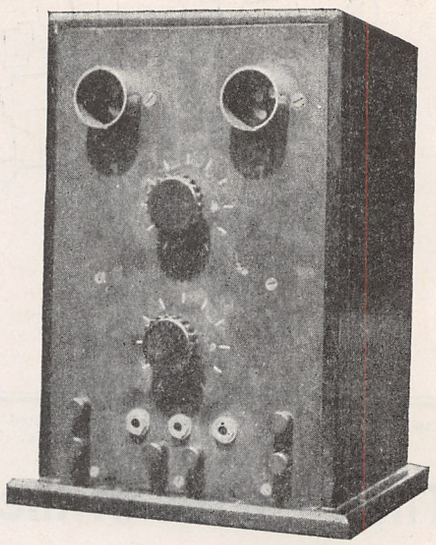
The rheostats can be of most any type, several good ones being on the market. The main features of the rheostats are smooth running and good contacts, ability to resist the action of the heat, and to give a fairly close adjustment of filament current. Much of the noise from the filament circuit centers in the sliding contacts of the rheostat. The rheostats should have an "Off" position, to avoid the use of a switch in the filament circuit.

The most important pieces in an amplifier are the tubes, then the transformers. In this amplifier transformers, with a three to one ratio, were used. The relative position of these transformers is very impor ant, if the amplifier is to be quiet, and is shown clearly in the back view of the apparatus. The transformers should be spaced as far apart as possible.

The two horizontal or mounting boards are ¾" pine, 7" wide, and 6" deep. They fasten to the panel with flat head brass screws through the countersunk holes in the panel. The lower board is cut away in the center to clear the pair of binding posts placed in the center of the panel, and the upper board is cut away to clear a rheostat. The lower board forms a sub-base for the apparatus, and is strengthened by a brace of brass, to the upper board. This construction is heavy, but adds materially to the efficiency of the amplifier.



Plan of the Front Panel Indicating the Exact Positions and Sizes of all Holes to be Drilled.



Front View of the Two Stage Amplifier in Its Cabinet.

The jacks used were two circuit jacks, and are inserted in the circuits, as shown in the diagram of connections. Some circuits, in amplifiers, place the phones in series with the primary of the next transformer, when plugged-in on any but the last step. This method inserts useless impedance in the phone circuit, while the method shown here disconnects all unused apparatus and connects the phones direct on each step.

Three pairs of binding posts are mounted on the panel, one pair for filament or "A" battery, second pair for "Input" and the third pair for connecting a loud speaker. The filament connection is simple and needs no explanation. It is connected to a six-volt storage battery, care being taken to get the right polarity. The "Input" terminals of the amplifier are connected to the "Telephone" binding posts of the audion panel,

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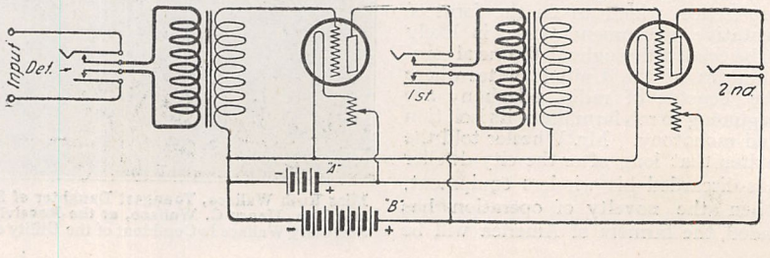
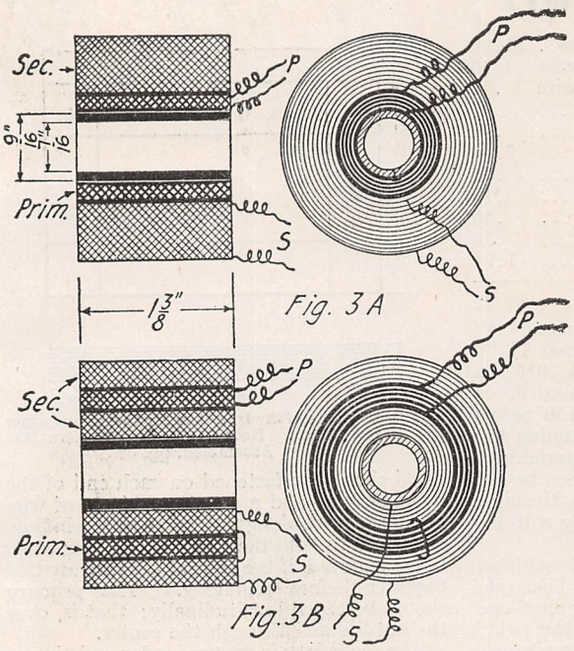
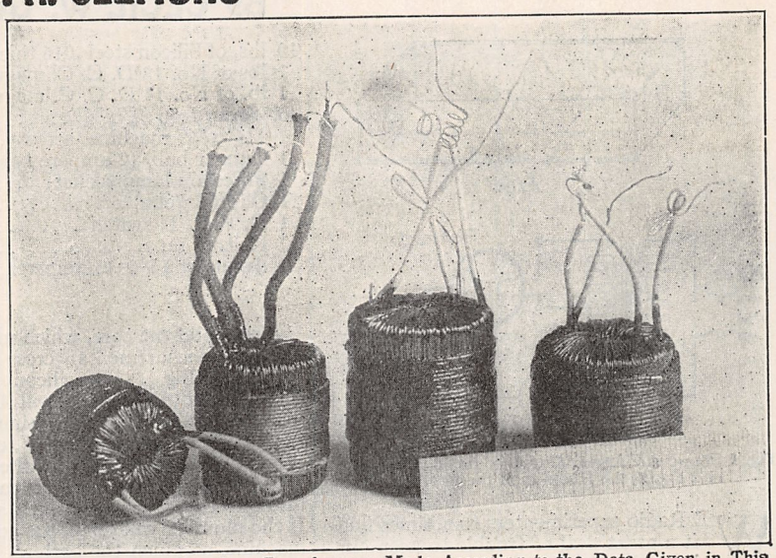


Wiring Diagram of the Two Stage Amplifier. The Jacks Are Used to Insert the Phones in the Output of the Detector, First or Second Stage.

An Efficient Audio Frequency Transformer

By D. R. CLEMONS





Above Are a Few Complete Transformers Made According to the Data Given in This Article. On the Left, the Sketch Shows Two Methods of Winding the Primary of the Transformers. Fig. 3A Shows the Common Method While Fig. 3B Illustrates the System of Sandwiching the Primary Between Two Sections of the Secondary to Obtain Tighter Coupling.

DURING their radio experience, operators often resort to odd appliances to aid in distinguishing signals too faint to be readily copied. This may be in commercial work, or in the civilian station. Sometimes we have plugged wooden wedges into windows, jar racks, doors, and other vibrating parts; finally resorting to a blanket wound around the head in order to receive long distance transmissions. Any operator desires a greater range and more sensitive receiver.

In former years, many microphonic devices and adjustable amplifying relays were tried with varying success, but with the development of the vacuum tube, there came a revolution in the field of amplifiers; for, in the tube itself, we have a thoroughly reliable and efficient amplifier. By using several tubes within amplifiers remarkable sensitiveness may be obtained, so that it is now possible to detect and strengthen signals thousands of times where before they would be unheard.

The construction of efficient amplifiers is not difficult where the accessories are offered on the market as they now are, the assembling or mounting being all that is necessary. However, in developing these separate parts, considerable work and experimenting is required. Theoretically, it is possible to design parts for greatest efficiency by mathematical computations, but for practical application, these will sometimes require minor changes for reasons which will be the substance of this work.

Assuming that one desires an amplifier; it is reasonable to also assume that the most efficient general purpose instrument is wanted; one functioning well on either telegraphic signals or speech. The usual limitation is, of course, the cost of the apparatus.

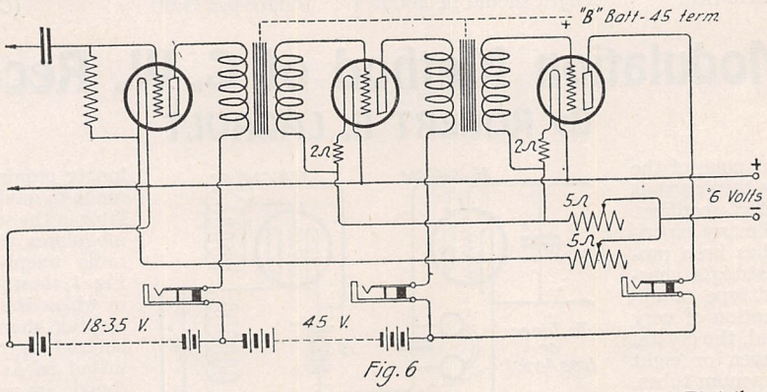


Fig. 6

Diagram of a Two Step Amplifier Connected to a Vacuum Tube Detector. Note That the Iron Core of the Transformers Are Connected to the Positive of the "B" Battery.

After the purchase, the maintenance is very low, providing that the operator uses caution after blowing out his first tubes by having burned them above normal. It seems that many radio people like to construct their own apparatus where possible, even though they may be able to purchase the finished product on the market. In this article, data for the construction of a very efficient and useful inter-tube transformer for audio frequency amplifiers will be illustrated and described.

The characteristics of a vacuum tube are those of a rectifier and amplifier combined. Very weak potentials may be impressed upon the grid-filament circuit and cause a much greater variation in the plate-filament circuit. It is desirable that final telephone potentials should be great, so if very weak signals are to be amplified, several tubes may be used to amplify by stages. In this case it is evident that the output of one tube must be connected in some manner to the input of the next tube in the series. The method of coupling the tubes for repeating gives the amplifier its name, as resistance, reactance or transformer coupling for radio frequencies, or for audio frequencies. In the radio frequency types the incoming signals are first strengthened and then detected for audibility. Resistance coupled types of this class do not operate well on low wave-lengths unless used with special apparatus for intermediate change of freqency. On its most efficient range it is very sensitive to weak signals, even though they are not made abnormally loud due to the liability to rectify within the amplifier itself and thereafter repeat at audio frequency. Transformer coupling is excellent upon wave-lengths for which they are designed, but are very critical and not flexible where one receives over a broad range of tunes. The more popular type seems to be the audio frequency transformer coupled amplifier, which amplifies tone frequency signals.

Consider Fig. 2: The plate circuit, including the transformer primary, conducts a

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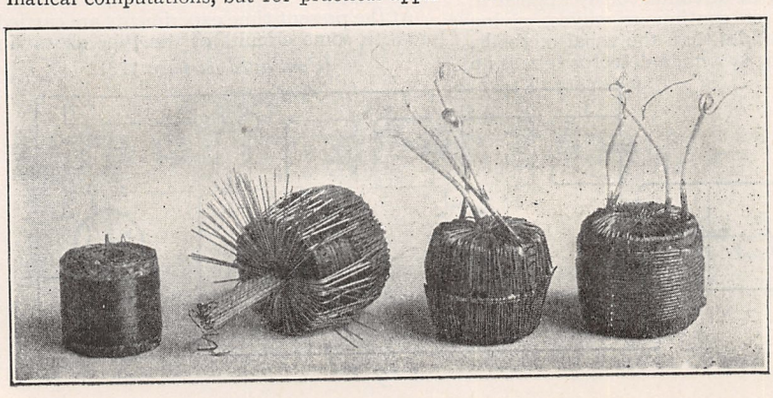


Fig. 1. In the photograph on the left may be seen the different steps in the construction of an amplifying transformer. Note how the iron core is formed.

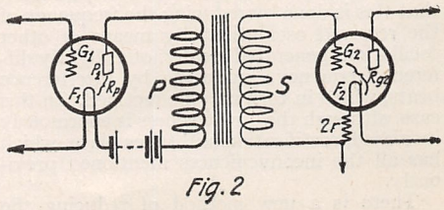


Fig. 2

Construction of a Tungar Rectifier

By CECIL W. GUYATT

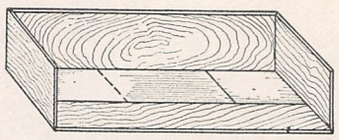


FIG.1 © RADIO NEWS

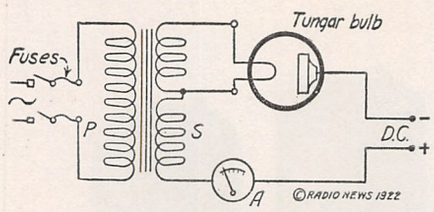


FIG.2

Fig. 1 Shows the Assembling Box for the Iron Core and Fig. 2, the Hook-up of the Rectifier.

WE Radio experimenters sometimes find it a great deal of trouble to keep our batteries charged, even if we happen to know a battery man who is perfectly honest. We might as well admit that one of our greatest desires is to possess a device that could be plugged into 110 volts, 60-cycle supply and deliver direct current of proper voltage at the other end. The following is a description of a Tungar Rectifier for battery-charging purposes.

The transformer is made up of a core, a 110-volt winding for the line, a secondary winding and necessary clamps. One of the first things an amateur wants to know is the cost. Therefore, a list of parts required to complete the rectifier is given herewith.

10 lbs. of Silicon steel .016 thickness..	$1.00
2 lbs of No. 18 D. C. C. magnet wire	1.40
1 lb. of No. 14 D. C. C. magnet wire	.50
40″ Strap Iron 3/16″x3/4″.....	.40
4–1½″x3/16″ machine screws.....	.10
1 Tungar bulb (2-ampere type).....	3.00
1 Porcelain lamp socket.....	.25
1 Clip (Eureka).....	.12
1 D. P. S. T. switch.....	.50
2 Rolls of tape.....	.20
1 Ammeter 15–0–15 amperes.....	1.75
	$9.22

First build the core, which measures 8″x5″ (outside measurements), cross section 1¼″x 1¼″, see Fig. 3. If silicon steel .016″ is used, about 300 pieces will be needed, or one stack 6¾″x2½″ containing 150 pieces and another stack 3¾″x2½″, containing 150 pieces. A plumber can cut the material into long strips 1¼″ wide, which can then be cut into pieces of proper length with tinsnips. If the plumber will do all the cutting with his machine, so much the better.

A right-angle box should be made with an 8″ inside measurement. (Fig. 1.) Then pile up one leg of the core by placing first one 6¾″ strip to left and then one to the right, until you have a pile that, when compressed, measures 1¼″ deep. Take this pile out, carefully compress in a vise and bind tightly with friction tape.

The primary winding into which 110 volts are impressed is composed of No. 18 D. C. C. copper wire, 400 turns being required. The primary should be wound on a slightly tapered wooden form, a little larger (⅛″–¼″ all around) than the core cross section and whose length should be about 4″. Square pieces of

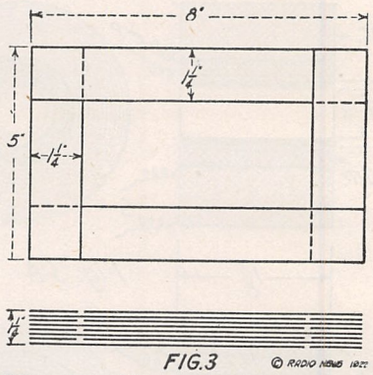


FIG.3 © RADIO NEWS 1922

The Dimensions of the Iron Core for the Transformer Are Given Here. Note How the Corners Are Assembled.

wood should be fastened on each end of the winding form and a couple of pieces of wire laid lengthwise along the form before winding, will serve to hold the winding together when being removed, if the ends of the wire are tied together before removing. The primary should be taped longitudinally; that is, over the outside and through the center.

The secondary is next wound, consisting of 100 turns of No. 14 D. C. C. wire, wound on the same form as the primary with a tap taken off at the tenth turn by making a loop about 3″ long. It is a good plan to soak thoroughly the wire in a hot bath of paraffin before winding, as this lessens the danger of the wire charring. As each layer is wound, it should be thoroughly shellacked and allowed to dry. Remove from form and tape.

(*Continued on page* 172)

The Modulation Method of C. W. Reception

By ROBERT E. LACAULT

IT is a well known fact that none of the detectors actually in use, be they crystals or vacuum tubes, are perfect rectifiers. In spite of much work and many experiments, no vacuum tube has been produced as yet which has a real straight characteristic curve; therefore this type of detector is inefficient for the reception of very weak signals. On the other hand, the crystal detectors, which are about seven or eight times more sensitive than the vacuum tubes, present such difficulties of adjustment that they are abandoned when real work is to be done, the operators having no time to spend in fussing with the well-known "cat whiskers."

Another defect of the detectors is that the intensity of the rectified current is about proportional to the square of the applied difference of potential; consequently, as mentioned above, a very weak signal fails to be efficiently rectified, unless a separate heterodyne is used. This increase of the sensitiveness seems to be due to the fact, pointed out by Major E. H. Armstrong, that it is possible to adjust the intensity of the heterodyne effect so as to make the detector work at the most favorable point, although even in this condition it is not as sensitive as may be desired. For these reasons, radio engineers have been led to seek other and better means of detecting signals than the rectifying method.

Considering the reception of C.W., we know that this is done by reducing the frequency of the received oscillations by means of other oscillations generated locally, of a slightly different frequency, producing by interference beats, which in turn may be rectified. In this case, although the sensitiveness is enormously increased, rectification still takes place, which has all the inconveniences mentioned previously.

There is a new method of reducing the

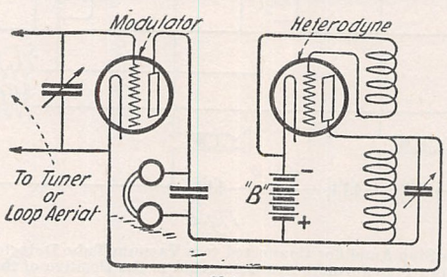


Fig. 1

In This Circuit for C. W. Reception the Signals Are Impressed Upon a Modulator Tube in the Same Way as the Speech in a Phone Set. Separate A Batteries Are Used.

frequency of C.W. to audio frequency, which is more efficient; this is modulation. Mr. R. Jouhaust, in a recent communication to the French Academy of Sciences, pointed out that some of the modulating systems used in radio telephony may be advantageously applied to the reception of continuous waves, giving much better results than the usual methods. In this receiving system, a detector tube is no longer required, as the incoming signals are made to modulate the output of a local oscillator in the same manner as a modulator tube modulates the output of the oscillator in a radio telephone transmitter. The circuit, Fig. 1, shows the connection of such a receiver in which the modulator tube acts as an absorption shunt to the oscillating circuit of the heterodyne, which must, of course, be adjusted so as to produce beats when C.W. signals are received.

The writer has conducted several experiments with this circuit, which is very sensitive, and which has proved really superior to the usual hook-ups. In Fig. 1 are shown the connections of a set which was used with a 4′ loop aerial. The plate of the modulator tube is supplied with high frequency only while the received oscillations are applied to the grid and filaments. The condenser shunting the telephones has a capacity of about .001 MF. The heterodyne must of course be designed to produce oscillations of the proper frequencies.

At the present time experiments are carried on with some circuits of the type shown in

(*Continued on page* 173)

This is the Same Circuit as in Fig. 1, but with Two Stages of Radio Frequency Amplification.

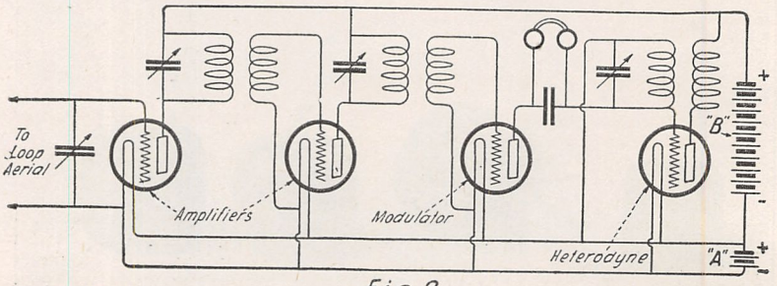


Fig. 2

Radio Digest

RADIO CONFERENCE COMMITTEE MEETS IN WASHINGTON

The Second Session of the General Radio Telephone committee, headed by Dr. S. W. Stratton of the Bureau of Standards appointed by Secretary Hoover to prepare a draft of an agreement of wave-length assignments for amateurs and commercial transmitting stations, met on Monday, April 17, at the Department of Commerce at 10 A. M., to raise the laws and regulations.

Recently this committee recommended that radiophone sending stations be grouped into 20 different wave bands between zero and 6,000 meters, as follows: Transoceanic telephone experiments, 5,000 to 6,000 meters; Fixed service radio telephony, 2,850 to 3,300; Mobile service radio telephony, 2,500 to 2,650; Government broadcasting, 1,850 to 2,050; Fixed station radio telephony, 1,550 to 1,650; Aircraft radio, 1,500 to 1,550 exclusive; Government and public broadcasting 1,050 to 1,500; Radio beacons, exclusive, 950 to 1,050; Aircraft radio, exclusive, 850 to 950; Radio Compass, exclusive 750 to 850; Government and public broadcasting, 700 miles inland, 700 to 750; Mobile radio telephony 650 to 750; Mobile radio telegraphy exclusive, 525 to 650; Aircraft radio, exclusive 500 to 525; Private and toll broadcasting, exclusive, 310 to 435; Restricted special amateur radio telegraphy, 310; City and state public safety broadcasting, exclusive, 275 to 285; Technical and training schools (shared with amateur) 200 to 275; Amateurs (exclusive, 150 to 200) shared with technical and training schools, 200 to 275 meters; Reserved below 150 meters.

It is understood that as soon as the committee definitely agrees upon the standard allocation of wave-lengths, Representative W. H. White, Jr., of Maine, will introduce a bill in the House of Representatives to provide the legislation for Secretary Hoover to control legally the allocation of radio waves and administer the operation of all radio transmitting stations.

The names of those serving on the committee follow:

GENERAL COMMITTEE ON RADIO WAVES—

Dr. S. W. Stratton, Chairman (Director of Bureau of Standards).

Major General George O. Squier, War Department.

Capt. Samuel W. Bryant, U. S. N., Navy Department.

Mr. J. C. Edgerton, Supt. Radio Service, Post Office Dept.

Mr. W. A. Wheeler, Bureau of Markets and Crops Estimates, Department of Agriculture.

Representative Wallace H. White, Jr., of Maine.

Mr. R. B. Howell of Omaha, Nebraska.

Dr. Alfred N. Goldsmith, Secy. Institute of Radio Engineers, N. Y.

Mr. Hiram Percy Maxim, Pres. American Radio Relay League, Hartford, Conn.

Prof. L. A. Hazeltine, Stevens Inst. of Technology, Hoboken, N. J.

Mr. D. B. Carson, Commissioner of Navigation, Dept. of Commerce.

Prof. C. M. Jansky, Jr., University of Minnesota.

Senator Frank B. Kellogg of Minnesota.

Mr. Edwin H. Armstrong, Columbia University, New York.

NEW RADIO STATION IN RUSSIA.

Work on the construction of the new radiotelegraph station at Dyetsky village is approaching completion. The old station was destroyed in 1919 in the Yudenitch advance. All that remained were the workmen's dwellings some distance from the station. A special railway branch was made to aid in the reconstruction which was begun in September, 1920. A new building for the machines, etc., and five 125-meter masts have been erected. The machines are nearly all installed. Siemens-Schuckert made the electrical machines and distributing apparatus; Siemens-Halske & Ericsson the radiotelegraphic parts; Nobels the Diesel motor; and the "Pharphorovni" concern the insulators.

RADIO FOR FRENCH PILOT BOATS

France has established wireless telegraph posts at Rouen and pilot boats on the Seine which will be used to transmit messages relating to maritime affairs and the promotion of port services according to the Department of Commerce. The pilot boats, it is reported by Consul M. B. Kirk of Rouen, will transmit by wireless the arrival of all vessels coming up the Seine on every tide to the Post office and the P. O. will instruct the pilot vessels where to place the ships upon their arrival.

Three pilot boats have been equipped with radio using continuous waves averaging 520 meters. Ground stations employ 720 meter with an intermittent spark, except at night when 600 meter waves are used, as in commercial work. When merchant vessels are not equipped with radio, urgent messages are transmitted for them to their brokers, via the post office, for 40 centimes per word. The public radio station at Belleville handles all other radio messages not affecting the port.

Radio Articles Appearing in June Science and Invention

Electric Farm de Luxe
By H. Winfield Secor, E.E.

Dr. Hackensaw's Secrets—No. 6—The Secret of the Telautomaton
By Clement Fezandié

Church Broadcasts Own Sermons
By Archie Richardson

A Vacation-time Radio Receiver
By Robert E. Lacault

Radio for the Beginner—No. 4—Shooting Trouble in the Radio Receiver
By Armstrong Perry

How to Make Storage "B" Batteries
By Joseph H. Kraus

Radio-Frequency Amplification for Amateur Reception
By Arthur H. Lynch

Radio Broadcast

Radio Oracle—Question and Answer Box

SHIP'S POSITION TO BE ANNOUNCED BY WJZ.

Through arrangements concluded by the Radio Corporation of America, the Newark radiophone WJZ broadcasts daily at 8:00 p. m. positions of vessels at sea as reported to the corporation's several stations along the Atlantic Coast and forwarded to the Marine Radio Bureau, 64 Broad Street, New York City.

It is expected this additional service will be of real benefit to everyone interested in ships and their movements.

TAXI COMPANY WILL USE RADIO

The Yellow Taxicab Company will use radio to expedite the handling of its fleet of 1,500 yellow cabs in the Chicago district. Construction of a radiophone transmission plant on the roof of the company's main garage and installation of receiving stations at outlying garages, as well as portable receivers on the cars used by traveling superintendents, has been started. According to reports, the Western Electric Co. has undertaken the job.

Central office can in this way keep in touch with the superintendents, notify them when boats and trains are late, what hotels and railway stations need cabs, and many other details peculiar to the rapid handling of the public taxi trade.

CLEARING THE PACIFIC AIR

After considerable difficulty in reaching a wave-length which does not interfere with the transmitting of the British and Japanese radio stations on the Pacific, the Naval Communication service has determined upon a wave-length of 13,700 for east-bound messages from the Naval Station at Cavite (NPO). A two weeks' test between Cavite and San Francisco (NPG) showed that with this length the signals from the Japanese station sending from Iwaki did not interfere as was previously the case. Originally the Cavite station sent eastern messages on 14,200 but that length interfered with the English stations and 13,900 was tried out with interference from Iwaki. Today, however, NPO comes through to San Francisco on 13,700. Westbound messages from San Francisco and San Diego are not sent direct to Cavite, but relayed through Pearl Harbor.

NATIONAL RADIO CHAMBER OF COMMERCE FORMED

At a meeting just held in New York, the newly organized National Radio Chamber of Commerce definitely outlined plans and elected temporary officers. The officers elected at this meeting are: President, Alex. Eisemann of the Freed-Eisemann Radio Corporation; First Vice-President, Charles Keator of the De Forest Radio Telephone and Telegraph Company; Second Vice-President, William Dubilier of the Dubilier Condenser Co.; Secretary, Frank Hinners of the Home Radio Corporation; and Treasurer, Joseph D. R. Freed of the Freed-Eisemann Radio Corporation.

The purpose of the National Radio Chamber of Commerce is to remedy certain conditions which have arisen in the radio industry as a result of its tremendous growth within the last few months; and to group together manufacturers whose radio products are of such dependable character as to maintain favorable public opinion toward the radio industry.

It is stated that all radio manufacturers, whether large or small, will be eligible for membership. The original group consisted of about 15 manufacturers. To this body there will be added, by invitation, about 20 additional concerns whose business standing and whose products are known to be of high order. New concerns will be eligible after their apparatus has been passed upon by a Board of five members. This Board will be appointed at the next meeting after new members, whose products have already been passed upon, are added to the membership list.

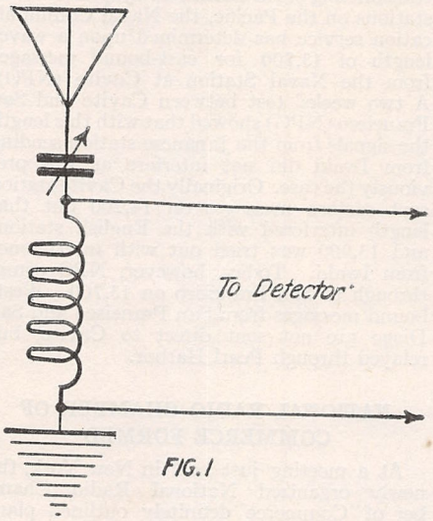
It is planned to exclude from the membership various concerns which have been organized purely for stock-jobbing purposes, and to exclude also manufacturers who are now turning out radio apparatus which has been found to be untrustworthy and which will eventually bring radio into disfavor on the part of purchasers of such undependable apparatus.

It is also stated that a large number of persons have entered into the business who

(*Continued on page* 164)

Practical Information on the Reception of Radio Signals

By A. F. VAN DYCK*



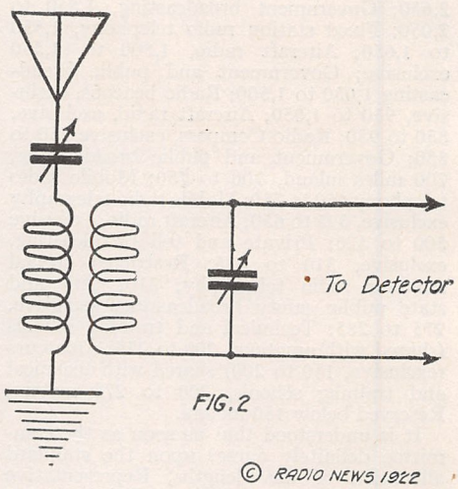
This Is the Simplest Tuning Circuit. The Wavelength is Varied by Adjusting the Variable Condenser.

UNTIL recently communication by Radio has been confined chiefly to two classes: First, commercial and military service between points which could not be connected easily by wire lines, such as ship to shore, aircraft to ground, etc.; and second, the use of Radio as a pastime by amateur experimenters. Recently, however, the development of Radio telephony to commercial practicability has made it possible for persons not familiar with telegraph codes to send and receive Radio signals without any study or practice. Furthermore the possibility of sending out telephone concerts, news items, etc., from central Radio stations has interested a very large number of people who do not care to experiment with Radio apparatus, and this forms a third and new class of Radio communication. It is the object of this article to explain the principles of Radio sufficiently to make clear to such persons how Radio communication works.

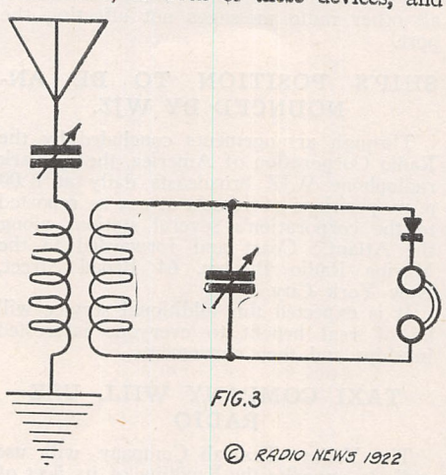
First, we should consider what a Radio transmitting station is. If we erect a wire in the air above the ground and by some means cause an alternating current to flow in this wire, disturbances are produced in the ether around the wire, which travel away from the wire in all directions. Alternating currents of ordinary commercial frequencies such as 60 cycles might be used, but would not work very well. The disturbance in the ether will be greater the higher the frequency, and very high frequencies are used to get practical results. Radio transmitting stations use alternating currents of frequencies from 15,000 cycles to about 1,500,000 cycles per second. Of course special means are necessary to generate these very high frequency currents. We do not need to study just how these currents are generated in order to understand Radio reception. It need be understood only that alternating currents of very high frequency, when flowing in an elevated system of wires, send out ether disturbances, or waves, which constitute Radio transmission. Communication by means of these waves is accomplished by telegraph or telephone. If telegraph is desired, the alternating current in the elevated wire or antenna is started and stopped by means of a key, according to certain dot and dash symbols in the same way that wire telegraphy is carried on. If telephony is desired, the alternating current is arranged to flow in the antenna wires continuously, and the amplitude or strength of this current is varied in accordance with the variations of the speaker's voice.

*Radio Engineer, General Electric Company.

These disturbances or waves in the ether travel in all directions, and if they strike any wire during their travels, they generate in that wire electric voltages of the same frequency as that of the alternating currents in the transmitting antenna which produced the waves. It is very important to notice this point. A receiving station is fundamentally nothing but a wire erected in the air, which will have voltage generated in it by waves passing through the ether, and further, that the voltages generated will have the same frequency as the frequency of the transmitting station from which the waves come. After the voltages are present in the receiving antenna, it is necessary to do two things: First, to make the currents which flow in the antenna, due to the voltage, as large as possible; and second, to provide some means for using or indicating these currents to make intelligible signals. The first of these requirements, that is, making the current in the receiving antenna as large as possible, is accomplished by the process known as tuning. Tuning consists of connecting in the antenna circuit a coil of wire, known as an inductor or condenser, which has a few metal plates near each other, but insulated from each other, or both of these devices, and adjusting the size of them (they are so made as to be conveniently adjustable) so as to make the current flow at a maximum. This results because turns of wire have one effect on opposing the flow of alternating current and condensers have another effect, so that when the two are made equal, they neutralize each other and the current becomes as large as the pure resistance of the wire will permit. So that the first part of any Radio receiver is the tuning part, whose function it is to make the current from the received wave as large as possible. In other words, tuning is simply adjusting the receiving apparatus for the frequency of the transmitter to be received so that it will get maximum current from that transmitter.



For Better Results the Primary and Secondary Should Consist of Separate Coils Forming Distinct Circuits Which May Be Tuned Individually.



This Complete Receiver Circuit May Be Tuned Sharply, Thanks to the Variable Coupling and the Variable Condenser.

The second requirement in reception, which comes into the problem after the current is as large as possible, is to convert this current, which is an alternating high frequency current, into direct current or low frequency alternating current. This is necessary because high frequency current will not operate a telephone receiver and low frequency or direct current will. This additional device is practically a rectifier, and is called a detector. There are two kinds of detectors now in use: One is the crystal detector which consists of a small piece of mineral resting on it; this requires no batteries to operate, but does require adjustment of the point on the mineral crystal to get a sensitive spot. The other type is the vacuum tube which is a better detector, and easier to keep in adjustment, but which is more expensive and requires batteries to operate. Either type of detector can be used for receiving Radio telephone signals. The current which comes out of the detector operates the telephone receivers producing the audible telegraph or telephone signals, which were sent out by the transmitting station.

(*Continued on page* 134)

Awards of the $50 Radio Wrinkle Contest

First Prize

A VERNIER CONDENSER

By W. A. CORVEY

The prize winning suggestion for a vernier condenser combines simplicity and utility. It is easily constructed and certain in operation. It is better than a mechanical vernier as the latter is usually not so staple and reliable, unless it is exceedingly well designed. Any amateur can make this vernier condenser which is shown in Fig. 1.

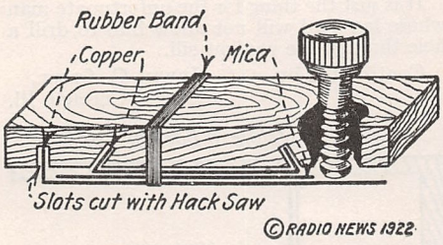


Diagram of the Vernier Condenser Submitted by the Winner of the First Prize. This Little Condenser is Very Simple in Construction But is Useful and Reliable in Operation.

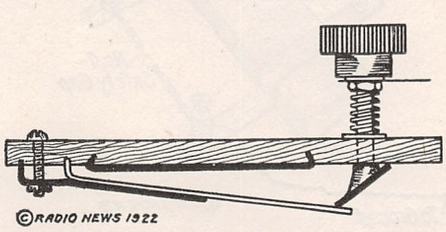
It consists of two small copper plates separated by pieces of Mica. A screw passing through the little panel on which the condenser is mounted, bears upon one of the plates, raising it away from or lowering it nearer to the other plate. The capacity of the condenser is very small and the control permits very fine adjustment. The rubber band acts as a spring to keep the movable plate pressed against the screw.

The fixed copper plate measures .9″ by 1.3″. Saw-cuts, as shown in the diagram, are made in the panel, which may be a piece of hard rubber or hard wood. The fixed plate is bent over .1″ at each end, and slid into the saw-cuts. A piece of mica is pasted over the plate to completely cover it. The movable plate measures .9″ by 1.5″ with .1″ bent over at one end to enter the slot in the panel.

The screw is a machine screw of any size with knob attached, and the hole in the panel is tapped to take the thread on the screw.

Mr. Corvey submitted another similar design of vernier condenser. This is not quite so simple to construct as the other, but, for the sake of those who are handy with tools, we also show this design in Fig. 2.

The dimensions are the same as the first. The difference lies in the method of varying the position of the movable plate, and obtaining tension. A piece of ⅜ inch brass 1.1″ long is used as a spring to hold the control, and there is a cam to raise or lower the plate. The brass spring is bent over .1″ and inserted in the slot, as indicated. It is held in position by a screw and bolt through the panel. The cam control consists of a machine screw with a large deep head. The head is filed down on one side so that the circular pieces measuring .4″ in diameter may be soldered to the screw at an angle of about 40 degrees. The screw passes through the hole in the panel, a washer is laid on, then a spiral spring, and next, a nut; finally, the knob is screwed on. When the knob is turned the cam raises or lowers the movable plate.



A Similar Design of Vernier Condenser Suggested by Mr. Corvey with a Cam Arrangement for Raising and Lowering the Movable Plate.

Second Prize

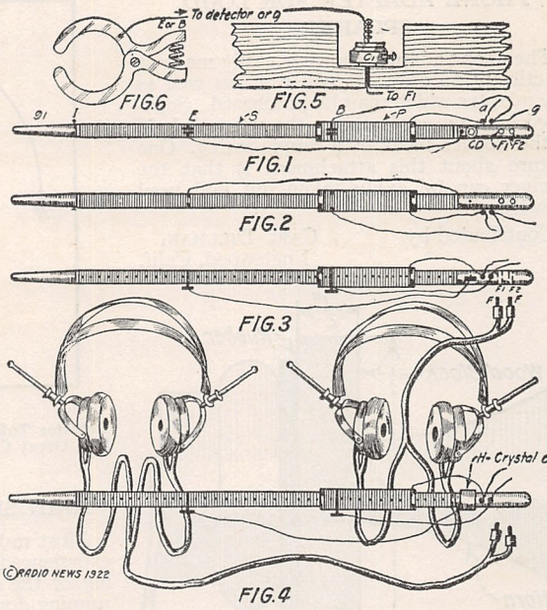
A WALKING-STICK RECEIVER

By Z. SEKINE

This is a simple, portable, and unique radio receiving set with a crystal detector and loose coupler. It is entirely constructed on a walking cane. The secondary coil is wound directly on the cane as shown in Fig. 1. The primary coil is wound on a cylinder made of cardboard just large enough to slide over the secondary. The secondary coil wire is magnet No. 26 and has 1100 turns. The primary coil wire is No. 24 with 200 turns. The crystal is placed in the handle of the cane at C D in Fig. 1, and the details can be seen in Fig. 5. In Fig. 3 F1 and F2 are holes lined with a thin sheet of brass and F and F1 are connected for operation.

The taps are taken every ⅞ of an inch on the secondary, and every half inch on the primary. The clamps E and B in Fig. 1 are used for tuning and they are made of copper wire which may be seen in Fig. 6 for construction. The entire hookup may be seen in Figs. 1, 2 and 3, and Fig. 4 shows the complete set. In Fig. 1, G is shown ground wire which may be used for outdoor operation by sticking it in the ground and, in this case, G may be connected on I.

This little set receives music and signals over a distance of about forty miles.



This Unique Design of Portable Crystal Receiver is in the Form of a Loose Coupler and Possesses the Advantage of Being Practical.

PRIZE WINNERS

First Prize, $25

Mr. W. A. Corvey, Fulton, Missouri.

Second Prize, $15

Mr. Z. Sekine, 192 Maple Avenue, Red Bank, New Jersey.

Third Prize, $10

Mr. Irwin C. Stoll, 2259 Leland Avenue, Chicago, Ill.

Third Prize

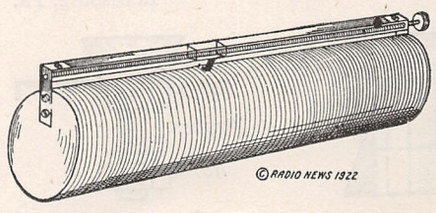
AN ORIGINAL TUNING COIL SLIDER

BY IRWIN C. STOLL

With the slider illustrated in the diagram, it is possible to obtain very fine adjustments. It is particularly adapted for small tuning coils, as it might not be convenient on large coils. It is intended to be used on the secondary coil of a small loose coupler, although it may be adapted for other purposes.

A long piece of ¼″ square brass tubing, with one side removed, is used as a path in which the slider moves on a threaded rod. By turning the rod at one end, the slider, held in position by the brass tube, moves up or down the thread on the rod. The brass tubing is cut the same length as the tuning coil and is held in position by the end pieces shown in the diagram. These two end pieces are cut and drilled as indicated, and screwed to the ends of the tuning coil. The top of each end piece is bent over and a small screw passed through the hole and a corresponding hole drilled in the top of the brass tubing. A small bolt on each of these screws holds the tubing firmly to the end pieces.

The threaded rod consists of a length of brass rod turned down at each end, as shown, to pass through the remaining holes in the end pieces. The long end is threaded with an $\frac{8}{32}$ die to take the knob. The main thread on the rod may be large or small, according to the needs of the experimenter. If a very fine variation is desired, the thread is made small. An $\frac{11}{24}$ die will probably be found best. The slider consists of a piece of ¼″ square brass stock ¾″ long, drilled and tapped to take the thread on the rod. A piece of phosphor bronze is soldered to the base of the slider to make contact with the tuning coil.



When the Knob on the Right is Turned the Slider Slowly Moves Along the Threads of the Rod, and a Very Fine Adjustment of Tuning is Obtained. This System is Particularly Suitable for Small Tuning Coils.

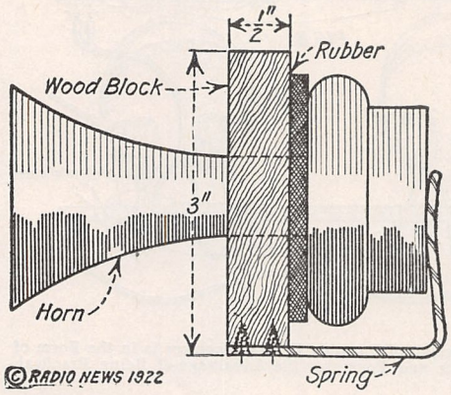
(Editor's Note: The contest for which these prizes are now awarded was announced in the April-May issue of RADIO NEWS. No results were published last month as nothing sufficiently novel or interesting was entered in the contest. Hereafter, these awards will be made each month and the best offerings will receive the prizes, as announced on Page 63 of this issue.)

Useful Hints for Amateur Constructors

PHONE ADAPTER FOR LOUD SPEAKER

The phone adapter shown is easily made at practically no cost. It will work as well as any adapter which may be purchased. Separated by a piece of rubber, the phone is held to the wooden block by a simple spring. One feature about this attachment is that the receiver can be easily taken out and used elsewhere.

Contributed by CARL DILLMAN,
Englewood, Calif.



An Easy Method of Connecting the Phone to the Loud-speaking Horn. The Phone Can Be Slipped In and Out With No Trouble.

SWITCH KNOB FROM A SPOOL

A simple switch knob may be made from an old spool and used for small sets.

The top of a spool is cut off at the groove and sand-papered until it is smooth. This forms the knob which should be painted with several coats of black enamel. The machine screw is inserted through the hole in the knob and a lever, made from a piece of brass, tightened to the knob with a nut.

Contributed by A. L. BYGDEN,
Jamaica South, Long Island.

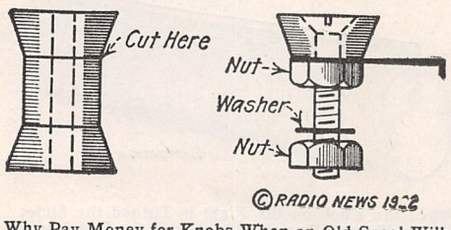
SIMPLE VERNIER RHEOSTAT

A close control of the filament current is sometimes a great convenience, especially with some types of detector tubes which require critical adjustment. If the vernier rheostat illustrated is used in series with the ordinary type of rheostat it will greatly facilitate this.

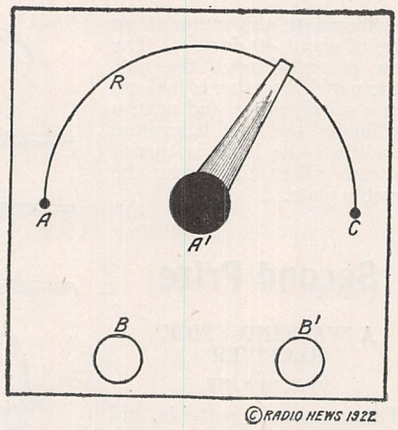
To construct this vernier, procure a wooden base about 2½" square, two screws, two binding posts, a switch lever and a piece of resistance wire.

Assemble the parts as shown in the diagram, connecting A and A′ to B and B′. The resistance wire is merely fastened to the screws, A and C, and allowed to spring upward, thus pressing upon the switch lever. This device will be a help in tuning for C. W. and phone.

Contributed by DONALD H. ROSS.
Lewisburg, Pa.



Why Pay Money for Knobs When an Old Spool Will Do the Trick? Sand-papered and Enamelled They Have a Good Enough Appearance for Most Purposes.



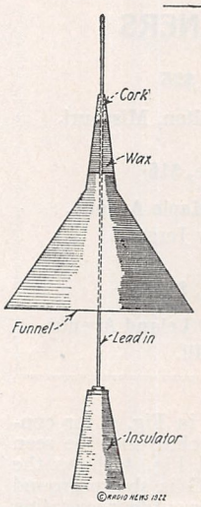
Detector Tubes Are Sometimes So Critical That It Is a Great Convenience to Use a Vernier Rheostat Like This One.

RAIN SHIELD FOR THE LEAD-IN

Most radio men using outside aerials have experienced trouble in preventing the grounding of the antenna in wet weather by rain running down the lead-in. The shield shown in the diagram will assist in avoiding this trouble.

The funnel is an ordinary one such as that used by garages for pouring oil or gas into a car. A cork is obtained which will fit in the top of the funnel from the inside. The aerial lead-in is brought through the funnel and a hole made through the middle of the cork. The cork is pushed tightly up into the funnel, and the end of the funnel is about one quarter filled with sealing-wax to make it water tight and free from wobble.

Contributed by IRWIN LINEHAM,
Chicago, Ill.



Often the Rain Trickles Through an Antenna Lead-in Insulator and Reduces the Efficiency, Particularly When Transmitting. This Simple Shield Will Prevent This.

VERNIER ADJUSTMENT ON DIALS

A vernier adjustment to be used on the dials of condensers may be easily made with the following parts:

3/16" rod
¾" rubber stopper
Knob to fit on rod
Cuff to fit rod

The rod is set out about three inches from the front of the panel which assists in eliminating the hand capacity effect when tuning for C. W. The rod passes through the panel and is inserted in a hole at the back of the cabinet. The cuff on the rod is brought close to the back of the panel. The rubber stopper is cut in half and a hole drilled through the middle. The rod is passed through with the larger end of the stopper towards the panel. The dial bears against the tapering rubber.

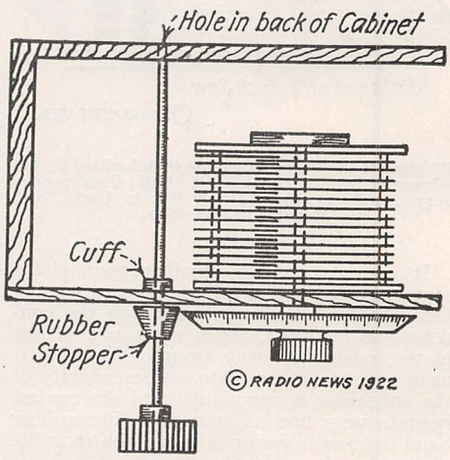
Contributed by W. B. JONES, JR.

A NEW LEAD-IN

From a piece of 1½" brass or copper strip, as used on Oscillation transformers, cut 2 strips 15" long. Drill one hole at each end of both strips. Lay the strips across the window sill and close the window. The strips will be formed, and allow the window to close. Tack the strips to the sill with small tacks and give them both a very light coat of paraffin to insulate them in case water gathers on the sill. At the outside end of each strip, connect double binding posts. The antenna is connected to one and the ground to the other. In the second holes of each of these binding posts insert a piece of No. 4 wire to make a safety gap as shown in the sketch.

It is just the thing for the unfortunate man whose landlord will not allow him to drill a hole through the window sill.

Contributed by IRWIN C. STOLL,
Chicago, Ill.

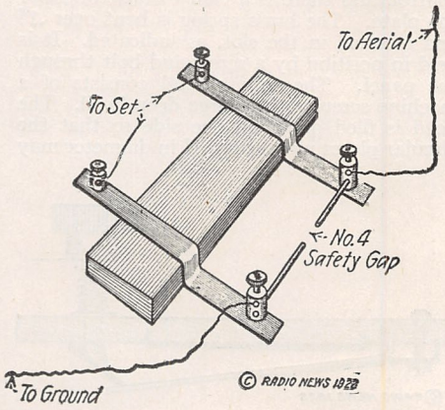


This Mechanical Vernier for Dials Will Reduce Body Capacity Effect and Permit Close Tuning.

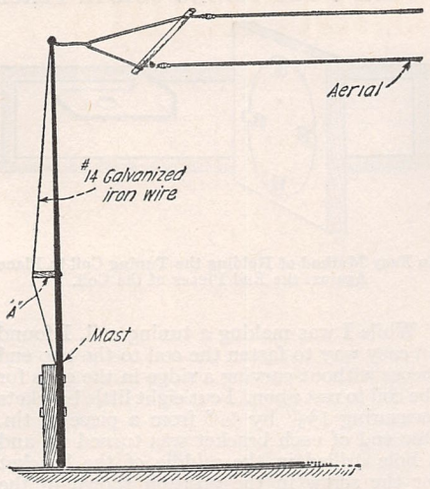
BULB SHIELDS

My amplifier squealed so loudly when I put my hand near the vacuum tubes that it greatly retarded radio reception. A metal shield was placed on the panel but it did not help much. Then I made a paper tube which would slip over the vacuum tube and project about ½" from the top. The paper tube was painted with aluminum paint. I made these tubes for all of my bulbs and the results were remarkable. The squealing almost disappeared, permitting much better reception than before the bulbs were shielded. The aluminum gilt can easily be obtained at any hardware store.

Contributed by R. EASTON,
Bellevue, Pa.



The Landlord Sometimes Objects to Holes Being Made Through the Window Sash. In That Case Use This Kind of Lead-in.



With this Arrangement the City Dweller Can Hold His Antenna Poles Rigid Without Stringing Guys to Adjoining Property.

A BRACE FOR THE AERIAL MAST

In almost every community a visiting amateur generally finds a few unsightly, sagging poles that give radio a "black eye." It happened that a friend of mine had a very thin pole he wished to erect that was about 25′ high. Now, a mast of these dimensions is easily bent by the slightest pull of the aerial or wind, but it was found that if a piece of heavy galvanized guy wire was stretched as a sort of truss, as is shown in the illustration, the mast was held straight.

It is best to fasten the wire securely to the top of the mast and then stretch it to the bottom and fasten it there with nails or bolts. Then a short piece of wood, "A," is forced between the pole and the wire, as shown. This piece of wood should be securely fastened to the pole with nails or screws and a large staple should be hammered over the wire at the other end.

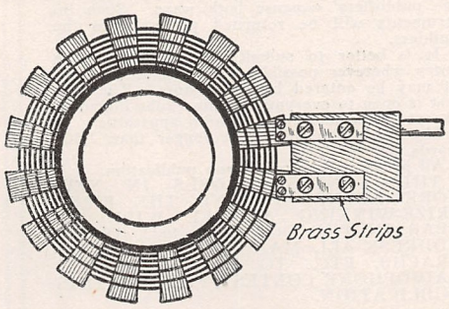
When the wire and stick "A" are in place it may be found that the pole bends backwards, due to the tension of the wire, but when the aerial is erected the strain will be neutralized and a straight pole will result.

Using this method, poles 25′ to 30′ high can be held rigid without the aid of external guys which makes this type of bracing especially desirable in crowded cities where it is impossible to secure permission to string guy wires on the adjoining property.

Contributed by HARRY LUBCKE,
Alameda, Calif.

MOUNTING SPIDER-WEB COILS

So many amateurs have honeycomb coils and mountings that I conceived the idea of adapting the honeycomb coil mounting for use with home-made spider-web coils. This was accomplished by connecting the latter coils to the plug in the manner shown in the diagram. The coils must be wound on a bakelite or hard rubber form. Two pieces of brass to secure the form to the plug are cut in the shape indicated; two holes are drilled in the strip and corresponding holes through the honeycomb coil plug. In drilling these holes, care should be taken not to touch any of the metal points in the plug. The spider-web coil form is held to these brass strips by two bolts through the holes at the end of each strip. In mounting the coils the metal strips on the middle coil should be bent to bring it to the exact center and the other two coils are mounted with the side holding the coil plugs toward the center.



Spider-Web Coils Can be Connected on Honeycomb Coil Plugs in this Manner, and the Same Mounting Used for Either Type of Coil.

Contributed by BIRRELL MITCHELL,
Camas, Wash.

$50 in Prizes

WE have inaugurated a special prize contest for radio amateurs and beginners. There will be three monthly prizes, and all other ideas published will be paid for, at the rate of $2 each. The prizes will be as follows:

First Prize	$25.00 in gold
Second Prize	$15.00 in gold
Third Prize	$10.00 in gold
Total	$50.00 in gold

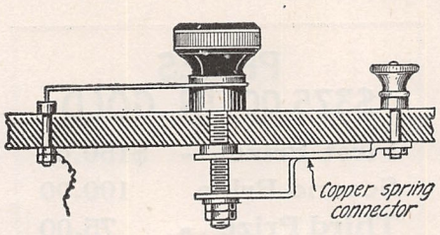
The closing date for this contest will be the first of each month, and results will be published the second month following. For instance, the closing date now will be July 1, and the names of the prize winners will appear in the September issue of RADIO NEWS.

We desire simple ideas exclusively for the beginner and the novice, the simpler the radio idea the better the chance to win the prize.

There are lots of valuable little stunts that you amateurs run across every month, and we mean to publish these for the benefit of the entire Radio Fraternity.

If possible, a clear photograph should be sent with the idea, but if that is not possible, a good sketch will do.

This prize contest is open to everyone. All prizes will be paid upon publication. If two contestants submit the same idea, both will receive the same prize. Address all manuscripts, photos, and models to *Editor Radio Wrinkle Contest,* care of this publication.

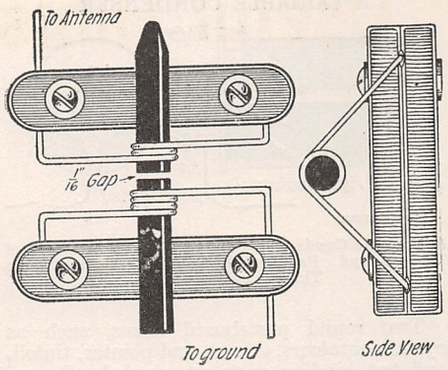


Permanent Contact is Maintained with this Type of Switch. The Piece of Bent Copper Connects the Center of the Switch to the Binding Post.

PERMANENT CONTACT FOR SWITCH

A common trouble in some receiving sets is a loose or broken connection on movable parts. This suggestion for the design of a permanent spring contact switch is made to eliminate this trouble. The essential part of the switch is a copper strip connecting the lever to the binding post. This does away with a wire connection which is apt to become loose or broken. The contact of the copper strip is maintained by bending it in the manner shown to form a spring action, and it is held in place by lock-nuts. This arrangement prevents loosening of the switch. I have used this very successfully, and have found it very practical and efficient.

Contributed by FREDERICK AYER,
New York.



A Lightning Spark Gap is Easily Made with Four Porcelain Cleats and Two Pieces of Carbon.

LIGHTNING SPARK GAP

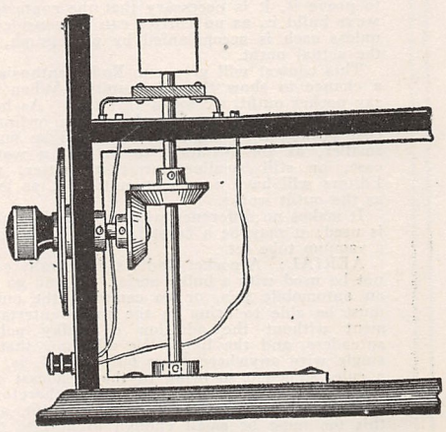
The protective device shown in the drawings is easily constructed and will conform to the rules of the underwriters for receiving stations. It will also provide added protection to the lightning switch of the transmitting station.

It consists of two short pieces of carbon such as are thrown away daily from street-lamps. Some of these are copper plated, which are preferable; four glazed two-wire porcelain cleats are arranged in pairs as indicated in the illustration. A few turns of bare copper wire of suitable size and stiffness hold the carbons in place. The carbons are separated 1/16". The wires are clamped between the cleats. In case the cleats do not "bite" hard enough, wind the wires with tape. The whole outfit need not cost over fifty cents and most of the material can be found in any amateur's junkbox.

Contributed by HARRIS C. HARVEY,
Buffalo, N. Y.

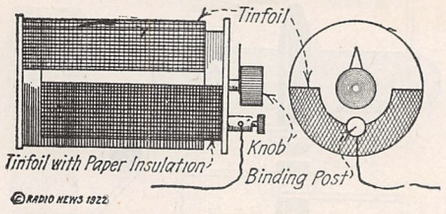
PANEL MOUNTING FOR LOOP AERIAL

The arrangement suggested by the diagram is a panel mounting for a loop aerial. By means of the dial on the front of the panel, a record may be kept of the directions of certain stations or the angle at which it is necessary to turn the loop in order to receive strongest signals from any particular station. A simple method of turning a loop without handling the wires and entangling the leads has sometimes been a problem to the experimenter. This method controls the loop by a simple gear arrangement. When the front dial is turned the gear at the end of the rod passing through the panel engages with the gear on the upright which supports the loop, and the loop is revolved. The ends of the loop wire are brought to two switch levers held to the upright and revolves with the loop. Each makes contact with a circular brass strip on top of the cabinet. From each of these strips wires are led to two binding posts on the front of the panel.



An Ingenious Method of Mounting and Turning a Loop Aerial. A Record Can be Kept of the Directions of Stations.

A VARIABLE CONDENSER



A Variable Condenser Can be Constructed Out of Two Round Pasteboard Containers and Some Tinfoil in this Manner.

Two round pasteboard boxes, such as oyster containers, a knob and pointer, tinfoil, and two binding posts are needed. One of the boxes should be slightly smaller than the other to fit inside.

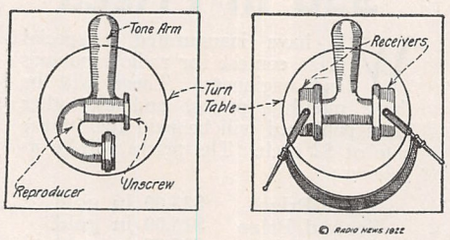
A piece of tinfoil is fastened to the inside box to cover just half of it, as shown in the drawing. A knob is fastened to the front of this box to turn it, and a binding post, which makes contact with the foil. A thin sheet of paper should be pasted over the tinfoil to insulate it. The outside box is covered in the same way as the inside, although, if the pasteboard is very heavy, it is better to fasten the tinfoil on the inside of the outer box.

Contributed by C. W. Lahman,
Franklin Grove, Ill.

USING THE SOUND BOX OF THE PHONOGRAPH AS A LOUD-SPEAKER

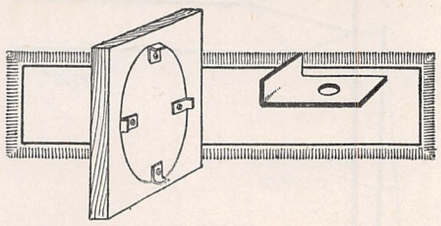
I have seen advertised for $3 a device by which a telephone receiver is attached to the phonograph in place of a loud-speaker. I accomplished the same result in a very simple manner. I removed not only the reproducer but the semi-circular arm which supports it. A double head set was laid on the turn-table with one receiver on each side of the tone arm. Both receivers were thus utilized and excellent results obtained. This stunt may be used with nearly every type of machine.

Contributed by Winthrop M. Leeds,
Germantown, Pa.



A Special Adapter is Not Necessary to Use the Phonograph Horn as a Loud-Speaker. If the Arm Which Supports the Reproducer is Removed the Phones Can be Held on Each Side of the Tone Arm.

HOLDING THE TUNING COIL IN PLACE



An Easy Method of Holding the Tuning Coil in Place Against the End Pieces of the Coil.

While I was making a tuning coil, I found an easy way to fasten the coil to the two end pieces without carving a ridge in the ends for the coil to rest upon. I cut eight little brackets measuring 1⅜″ by ½″ from a piece of tin. One end of each bracket was turned up and a hole drilled in the middle of the bracket for the screw in the position shown in the diagram. To mount the tuning coil, the circumference of the coil is marked with a circle on both the end pieces. The four brackets are screwed on each end piece around the circumference. The brackets clip over the tuning coil to hold it in place. When the slider rods are attached everything is secure.

Contributed by Carl Steinmetz,
Jersey City, N. J.

$375.00 Pocket Radiophone Prize Contest

(RADIO NEWS' Sixth Prize Contest)

WE present a new $375 prize contest to our readers, entitled

POCKET RADIOPHONE PRIZE CONTEST

We wish to say right here, in order not to mislead our Radio experts that we are using the word "Radiophone" advisedly. In popular parlance, a radiophone outfit these days means anything that can receive broadcast entertainment. In reality, and in technical language, a radiophone is an outfit which *transmits* radio telephony.

This contest has to do with a radio receiving set small enough to be placed in the pocket. At the present time, particularly, there is a lively interest being displayed for such outfits not only for vacation purposes, but for automobile work, motor boats, hiking trips, for the home, etc. The time is drawing near when the big, bulky outfit will be a thing of the past.

Radio News has always wished to advance the Radio art as much as possible and always tries to encourage new developments in the various Radio phases. Hence this prize contest.

As will be remembered, we ran a contest similar to this one in 1920, which was our third contest entitled "$100 Portable Radio Prize Contest." This contest differs from the former in that we restrict the size of the outfit so that it becomes a true pocket outfit. Remember that the Editors are not looking for freaks. The outfit must work and in order to prove it, it is necessary that the contestant must build it, as no entries can be considered unless each is accompanied by photograph, or the actual outfit.

This contest will give our Radio enthusiasts a chance to show their ingenuity. When we say pocket outfit, we mean just that. As long as the outfit can be slipped into an ordinary coat pocket, it is eligible. If it can be made smaller, as for instance, to fit into a watch case, or still smaller for that matter, the Editors will have no objection to this, as long as the outfit works.

It makes no difference what style of detector is used; it may be a crystal set, or it may be a vacuum tube set.

AERIAL: A pocket Radio set naturally cannot be used with a bulky aerial. If you go on an automobile trip, or go camping, the outfit must be able to bring in the radio entertainment without the addition of bulky poles, spreaders, and the like. We all know that a single wire anywhere from 60′ to 100′, is, as a rule, sufficient to bring in the broadcast entertainment reasonably clear. We, therefore, need besides the outfit, an antenna outfit, and this too must be small enough to fit into the pocket. That means, of course, that we must have a separate box or container to house the aerial wire, insulators, and other necessary paraphernalia. Of course, if the constructor can encompass the entire radio outfit, instruments and all, plus aerial in a single box or container, so much the better.

On the other hand, it would be almost impossible to build a vacuum tube set and fit it into the dimensions which we give below, and which must be surpassed. Such an outfit needs batteries, and it would, therefore, be allowable to have two separate boxes or containers, one to contain the Radio instruments with its tubes, while the other would contain sufficient batteries, aerial wire, etc. We appreciate that we do not allow much room for the batteries, but there are tubes made at the present time which may work without "B" batteries, using only the voltage drop from the "A" battery, which may consist of four dry cells to a voltage of 6, or thereabouts.

PRIZES
$375.00 IN GOLD

First Prize -	$150.00
Second Prize	100.00
Third Prize -	75.00
Fourth Prize -	50.00
TOTAL -	$375.00

In publishing the various ideas, all the rights revert to the publishers, the latter also reserve themselves the rights to publish all manuscripts sent in to this contest, although not prize winners; in that case full space rates will be allowed.

As will be noticed, the publishers offer prizes totaling $375 on the best idea for the most practical and efficient radiophone receiving outfit that will fit in the average coat pocket. Several radio experts will act as judges, and all judges will pass upon the manuscripts submitted so that all contestants will be treated fairly and impartially.

From the very nature of this contest, we are quite certain that it will not only bring out the very best there is in the American radio amateur but that it will advance the art for small radio receiving outfits considerably.

RULES FOR THE CONTEST

The receiving set to be eligible must be of the usual receiving type, vacuum tube or crystal detectors can be used at the option of the builder.

Some new constructional feature embodied in the outfit not used before will be necessary to win a prize.

It is necessary that the set has been actually built and must be either in use, or formerly used.

Mere ideas or patent descriptions, as well as commercial Radio outfits, are strictly excluded from this contest, which is only for individuals.

Where standard instruments, such as condensers, tubes, etc., are used, the make of such instruments must be stated.

A good diagram of the connections, well executed in ink, must be furnished.

A good photograph not smaller than 5″x7″, giving at least two views of the outfit is necessary.

A photograph of the builder is also required.

The size of the outfit itself cannot be larger than 4″ wide, by 6½″ long by 2″ high; these are the outside dimensions. It is allowable to have in addition to this, an extra container or box for the aerial, batteries, insulators, etc., but not more than two containers or boxes of this size are allowed.

Telephone receivers are not included, and can be separate, that is outside of these dimensions. It is, however, allowable for constructors to use a single telephone receiver and build this directly into the outfit so that the entire outfit can be held against the ear if such a construction is preferred.

All photographs, diagrams, and other data sent in by contestants, which are not used, will be returned at the publishers' expense.

Where the judges seem to have doubt as to the practicability of the instrument, they reserve the right to inspect and test the set. Insured parcel post charges for expressage at the publishers' expense both ways. Such instruments will be returned promptly to the builders.

It is better to submit the outfit with the entry wherever possible. More than one outfit may be entered by contestants. The contest is open to everyone, Radio Clubs included, except manufacturers of Radio apparatus.

Manuscripts must not be longer than 1,500 words.

All prizes will be paid upon publication.

THIS CONTEST CLOSES IN NEW YORK AUGUST 15, AND THE FIRST PRIZE-WINNING ARTICLE WILL APPEAR IN THE OCTOBER, 1922, ISSUE. ADDRESS ALL MANUSCRIPTS, PHOTOGRAPHS, ETC., TO EDITOR, POCKET RADIOPHONE CONTEST, CARE OF THIS PUBLICATION.

Who's Who in Radio

ELMAN B. MYERS

No. 17

An Interview With the Inventor

IN Radio development, as in automobiles or aeroplanes, it is the man who does the "stunts" who becomes the hero of the hour and occupies the center of the stage. On the other hand, men who give years of tireless effort to the development of the machine or apparatus which enables the hero to accomplish his wonderful feats are often lost sight of.

It is often these men who have gone through the trials and struggles of creative effort who really deserve the greatest credit. This is peculiarly true of Radio development, and possibly one of the most outstanding figures among this group of scientists who have never sought publicity is Elman B. Myers, of Jersey City, N. J.

On visiting him in his laboratories I was greeted by a man of modest mien who was very reticent until he found that I was a radio fan myself. On asking some questions regarding certain experimental work in progress, his face brightened with an expression which proved that after his many years of investigation he still retains his original enthusiasm.

At heart he is still a boy showing the keenest interest in anything relating to Radio investigation and even to answering my questions, which must have been very elementary to a man of his broad knowledge. He still has the greatest interest in the Radio Amateur and all through the present great demand he has seen that all individual orders from amateurs for material were given first attention.

Possibly few amateurs know that Elman B. Myers was the first to use the Galena crystal as a detector. He laughed as he told me of his discovery, saying that at the time he took a piece of the crystal to a Mr. White, who was then operator of the old Manhattan Beach station and was at the time using carborundum as a detector. Mr. White broke all receiving records in the next two weeks through use of the newly discovered material in radio application.

Few of the amateurs of today who nightly use their vacuum tubes realize that Mr. Myers manufactured the first audion tubes in America.

It was while acting as engineer for Dr. de Forest that he designed the present audiotron tube and equipped the first audion manufacturing plant in America, Dr. de Forest paying him a royalty of 30c. per tube.

MR. ELMAN B. MYERS

Back in 1909, when he was employed by the Poulsen Wireless Telegraph and Telephone Co., Mr. Myers designed and built the first Poulsen arc constructed in this country.

Right here I might relate some of the things Mr. Myers spoke of in connection with his experience while with the Poulsen company. They may give the reader some idea of the early struggles out of which our present Radio grew. At this time the Poulsen plant was housed in an old garage equipped with one old lathe and drill press. In common parlance of the street the company was "broke."

Mr. C. F. Elwell, then head of the company and now a Radio Engineer, pawned his diamonds to buy food for the men whose daily rations consisted of a bottle of milk and a loaf of rye bread. Mr. Myers said that at one time the men went without food for four days. Out of such purpose to succeed and indomitable will to do was our present Radio development accomplished. It is little short of a marvelous accomplishment when one considers the tremendous size to which the Poulsen company has grown.

It was while with the Poulsen company that Mr. Myers, associated with Mr. Logwood, observed the first beat note of the heterodyne circuit, brought about by the interference between two Radio telephone lines which he was then operating between Stockton and Sacramento, Calif., a distance of 50 miles. Later on, returning to the Atlantic Coast, he conducted the first Transatlantic tests made with an audion oscillator.

As early as 1912 Mr. Myers, at an expense of $35,000, erected and operated a high-power, broadcasting station at Albany, N. Y. From here he broadcasted regular programs nightly to a comparatively small audience. So much attention was created by this broadcasting that the New York *World* and other papers ran several illustrated articles concerning it and the Pathé Frères made a long film of the station in operation as a part of their news events.

It was about this time that the German liner, "Imperator," made her maiden voyage and Mr. Myers held Radio Telephone conversations with her operator while the ship was still far out at sea.

It was while operating the broadcasting station at Albany that Mr. Myers, working with Mr. Armstrong, supplied the energy with which Armstrong conducted several of his experiments with his regenerative circuit.

It may interest some to know that the great steel tower erected in New Jersey, from

(*Continued on page* 104)

Suggestions for the Summer

By HOWARD C. WILEY

THE QST* of the good old summer time is heard very QSA* at this season of the year and this call will cause considerable QRM* with radio unless we all QRX* and offset it in some way.

What shall we do to keep up the interest in radio during the summer? Someone answers that we don't have to do anything; that radio itself will not permit the interest to lag; that the broadcasting programs will continue to do all that is necessary, so, why worry? That is all true enough, but how about our friend (?) static. All powerful during the summer months! Think what a thunderstorm miles away is going to sound like in your Baldwins or on your Magnavox! No, after a few experiences with static spoiling perfectly good programs, the lights will be turned low and the dust will collect on the nice mahogany cabinets. My, what a "crepe-hanger" this fellow static is! Well, then, here is the bright side: The poor, overworked manufacturers of radio equipment will have a chance to catch up on their orders; by the fall we may be able to get a U.V.-200, even if we do have to part with most of our small change. The storekeepers will have enlarged their stores and their stocks and everything will be all set for one big time next winter.

What are we going to do this summer? As hinted above, we are going to have plenty of static. Why not practice on it? I do not mean cultivate it or encourage it in the least little way, but rather find some simple, easy trick which will reduce its horrible habit of mutilating a perfectly respectable signal or a classic violin solo. Just train those habits in the way they should go, i.e., where it is warm. It is not the purpose of this article to tell how this may be done; the pleasure is all yours.

Then, again, perhaps you live within receiving range of two or three broadcasting stations and know how any nice program can be turned into worse than jazz by not being able to tune each one separately. The writer, not long ago, had the pleasure of listening to Mr. Wm. J. Bryan, at KDKA, a minister preaching at WBZ and conversations to and from the "America," at the same instant. Deal Beach got first place, KDKA second, and WBZ came in when the others stopped. Why not study your set and find out what can be done to increase the selectivity. It is said that we may receive signals coming in on the same wave length from two or three stations and tune in the desired station according to its power and distance. "'Tis a consummation devoutly to be wished" as our friend Hamlet used to say to himself. We have all known the experience of building or buying a piece of apparatus in a hurry; installing in a hurry and getting the results as soon as possible. If we got any results at all, we were extremely fortunate and usually let it go at that; if we did not get any results we had to go painfully over the ground again, take more time, study the thing out and in the end probably get much better results than we would have if the thing had worked the first time. How lucky the fellow is whose experiments do not work the first time! How much better acquainted he is with his problems if he gets a few bumps on the road to success! All of which is intended to suggest to the gentle reader that the coming winter will be enjoyed very much more if your outfits are in the pink of condition. Do you remember your vacation last summer? How you lay on the sand for your breakfast to digest or waited for the tide so you could enjoy a swim? Do you remember the rainy days when life was a dreadful bore? Why not study up on this radio thing a bit? The Government Printing Office sells a book entitled, "Principles Underlying Radio Communications."

There is still another way to improve the summer months and one which will bring returns far in excess of anything you have experienced in radio yet, provided you are

(*Continued on page* 106)

Correspondence From Readers

ACCEPTED WITH PLEASURE

Editor, RADIO NEWS:

About a year ago I wrote you, what I fondly imagined, a very sarcastic letter in reference to certain "Correspondence From Readers," and your comments. It had to do with the A. R. R. L. and I am unfortunate enough to be hot-headed. After I sent it and ever since, until now, I have felt decidedly ashamed of my childish action.

I think I can see things more clearly now and I do not believe that two such factions as the R. L. O. A. and the A. R. R. L. should be antagonistic forever.

No doubt you have long since forgotten the above mentioned incident, but you will do me a great service by letting me know that my apology has been accepted. Also I desire very much to again be a member of the R. L. O. A. I sent in my membership certificate, but if possible or convenient I should like it returned.

C. E. MILLER.

Champaign, Ill.

CAN THIS BE ?

Editor, RADIO NEWS:

Having read Geo. C. Haseltine's article in the March issue of RADIO NEWS concerning his splendid galena record, I have decided to send you my record.

On the night of April 1, (this is no April fool joke), I received four different radiophone stations: KDKA, Pittsburgh, WWJ, Detroit, KYW, Chicago, and 2XJ (listed in call book as Elberon, N. J.). All of these were heard on galena.

I do not hear all of these every night, but always hear one or more. Part of the time when Detroit or Chicago was sending out the news I could hear Pittsburgh sending music. I think that if all of the large broadcasting stations would each send out on a different wave-length there would not be so much interference.

Let us hear from some more galena records.

JOHN M. SHANNER.

Oakland City, Ind.

ARE CANADIANS BECOMING AMERICANIZED BY RADIO ?

Editor, RADIO NEWS:

Everybody has heard of the many wonders of the radiophone. However, few people have ever thought what a tremendous influence the American high-powered radiophones are having and will have on Canadians.

As yet there are no regular nightly radiophone concerts given in Canada, so the only and most natural thing to do is to turn to the States for them.

There we hear music, talks, sermons, etc. These sermons and talks tend to teach the Canadians the American way of speaking and thinking, which is not always our way.

Take for instance the letter z. You pronounce it zee while we pronounce it zaid. Also the word theatre. In the States it is pronounced 'thee-ate-er,' while in Canada it is pronounced 'thee-a-ter. In time these words, along with many others are bound to work their way into Canada and one will hear them in every-day talk.

Also when one reads your magazines, and, in fact, any of your magazines, he notices that a number of words are shortened. An example of this is the word phone, also through; sometimes these words are spelled by you as fone and thru.

When a boy hears these high-powered stations for the first time he wants to find out where they are located. In doing this he is gaining a wonderful geographical knowledge of the States. After a fellow has heard several dozen stations he probably has a more accurate knowledge of the country across the border than he has of his own country.

The radio fans usually are boys who will be Canada's future men. Now if these boys are educated to think and talk like our friends over the line, our future men will be partially Americanized, which will not be the best thing for Canada.

There is but one thing that can curb this: Canadians must not be so narrow-minded and tight-fisted. Surely we can see that radiophone broadcasting stations are a necessity to the country, and most profitable to the owners. As RADIO NEWS stated recently, a broadcasting station nearly pays for itself in forty-eight hours. This is, of course, slightly exaggerated, but it means that it is highly profitable, and one wonders why there are not a number of electrical concerns in Canada with as large stations as there are in the States.

Long before two years are over we must have our own ether filled to overflowing with Canadian voices, Canadian music and Canadian news. Otherwise, we may suffer.

Suffer—how suffer? Doesn't it at once become clear to you? We hear American voices thronging the ether, American news and American thoughts. We at once begin to think and to talk as Americans. We become very friendly with Americans. We might go so far as to move to the States.

So, Canada, take heed, and don't lag behind in the greatest gift the Lord has given to mankind.

W. E. WEAVER.

Hespeler, Ontario, Canada.

Some of the Interesting Articles Appearing in the June Issue of Practical Electrics

Laboratory Motor.

Electric Hot Water Faucet.

Direct Reading Ohmmeter. By A. Giolitto.

Simple Testing Set. By Louis J. Albert.

Electric Arc Projection Lamp Circuit. By Roy Lindberg.

A Handy Switchboard for the Experimenter. By D. F. Hastings.

WE DON'T WANT TO TAKE THE BLAME

Editor, RADIO NEWS:

While reading RADIO NEWS, I saw your article on "Radio Broadcasting." I am an amateur and have built my own apparatus, but have no transmitting apparatus as yet. However, I expect to have a 100-watt phone set by the Fall. I have used the standard three honeycomb coil hook-up. I have heard WWJ, Detroit, KDKA, KYW and WJZ, all on 360 meters and all broadcasting at the same time, and have not been able to tune any of them out. I have had to listen to one of them while the others were squealing, and when Canute Field transmits I cannot hear anything at all. I believe he transmits on 485 meters. I think these stations should be strung out as you have stated; the spark ham is not always to blame.

MERWIN CROWL.

Gibson City, Ill.

CHANGE THE WAVE LENGTHS

Editor, RADIO NEWS:

I have read very carefully your article in RADIO NEWS entitled "Important New Radio Legislation."

Recently I have been listening to the various concerts broadcasted from Pittsburgh, Newark, etc., and the only interference that I had, other than static, was from commercial spark stations which were on low wavelengths. One was very loud and shut out all others and I tuned him in sharply on two points below Pittsburgh on the Westinghouse R. C. set. I get Pittsburgh on 25½ on the tuner.

Numbers of them come down as low as 30, and there is no possible way to tune them out. The only thing is to sit and wait for them to stop.

One night I was listening to the Point Breeze service and during the sermon some one started, throwing the voice completely out.

Therefore, let me suggest that some legislation be applied to make the spark commercial sets keep within a given range and put some device on their sets so that they can not be picked up on such a wide range of wave-lengths. I am not in a position to say if the latter can be done or not, but it is certainly needed.

Have received my first copy of RADIO NEWS and one article in it has been worth the year's subscription to me, provided it works as well as its writer says it will.

Would it be of any service to you to know the parties who send on such low wavelengths? The Government has a radio station near here and I can probably get some of the boys there to assist me and read the spark signals, as I can not, and in that way find out who they are.

A. G. TRENHOLM.

Georgetown, S. C.

BROADCASTERS, NOTE THIS

Editor, RADIO NEWS:

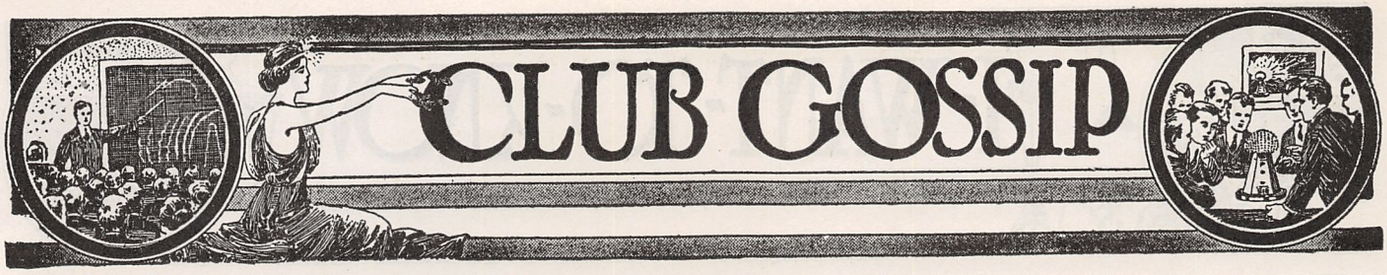
In RADIO NEWS, which I take regularly, I often see requests for suggestions; also nearly every broadcasting station asks for suggestions as to how they may better their programs and management.

I have a receiving set that I built from standard parts, with which I hear distinctly concerts as far distant as 1,000 miles, but I am not *always* able to hear the announcer sign off. Some repeat their Radio call letters, which is a good idea. Another suggestion is that they give these letters before and after each selection, and give them slowly and loudly. I have heard over 20 stations in the last three weeks and could only get the letters or locations of 15. Sometimes another station might interfere just when the letters were being given, or a crash of static might drown some of the letters, while a few seconds later I could hear the words of a song very distinctly.

Nearly every one who has a receiver wants to know to whom he is listening just as much as he wants to hear the speech or music. It took me a week to get the signing of WLK, WWJ and KGI, while I heard their concerts very clearly.

I heard WLK, who is about 900 miles away, very plainly, while KGY, who is 28 miles away, was in operation. I hear KDKA

(*Continued on page* 82)



VANCOUVER ISLAND RADIO CLUB

This Club was formed in December, 1921, with an initial membership of 12, and has since made steady progress, the membership now being 22. A start was made under favorable conditions when the Pacific Salvage Company gave the members the use of a large, well-lighted and well-heated room in the upper story of the building on their wharf for use as a club room. An aerial was run from the top of this building to the top of the post office, a distance of about 400' and as soon as sufficient funds were accumulated a tuner panel using honeycombs and spider webs and a separate V. T. detector panel were installed. With this the music from San Francisco Bay was brought in clearly and distinctly. Subsequently two more panels were assembled, one being a single stage of radio frequency and the other being two stages of audio frequency. Putting the radio frequency panel between the tuner and detector and the audio frequency panel outside of that and using a loud speaker made from a phonograph horn and a Type "C" Baldwin phone, first class results have been achieved. This apparatus was all purchased with Club funds and the next unit will probably be either a 10 or 20-watt C. W. transmission panel.

The use of a 200-meter wave for C. W. phone and key transmission, hitherto confined to the Eastern Provinces during the winter months, but for which general authority was recently given by the Department of the Naval Service, will undoubtedly result in relay work being taken up in earnest throughout Canada. It is hoped that when the new regulations which are in course of preparation by the Navy Department are completed, provision for 150 meters, minimum for spark stations, will be included.

Three C. W. transmission outfits are now under construction, 5DH, H. B. Elworthy, Victoria, with 10 watts, will be in operation by the time this reaches print, while Reeves at Duncan and Frampton at Mt. Tolmie will be in operation later. Burton, 5DX Victoria, the youngest and one of the most successful members of the Club, will have a ½-K.W. rotary spark in commission within the next two weeks, and Cooper 5AA of James Island has a ¼-K.W. rotary set well on the road to completion. A number of other good transmitting sets are projected and if they materialize will help to swell the number of relay league possibilities. There are any number of small spark sets and plenty of good receiving outfits on the Island, especially around Victoria, and some of these will probably develop during the summer.

On Thursday, March 9, a splendid lecture on the vacuum tube was given by Mr. K. G. Moffatt, the Government radio engineer, the club room being filled to capacity; the lecture committee is arranging for others at regular intervals. The first of a series of public concerts was given on Thursday, March 23.

The President of the Club is H. B. Elworthy and the Secretary-Treasurer is A. L. Poudrier; all communications should be addressed to P. O. Box 472, Victoria, B. C.

WOMEN'S RADIO LEAGUE OF AMERICA

The Women's Radio League of America, Inc., held its first annual meeting on Tuesday evening, May 2, in Room 907 Y. W. C. A. Building, 53rd Street and Lexington Avenue, New York.

The following officers were elected: President, Miss Abbie Morrison; Vice-President, Mrs. Eleanor G. Regan; Secretary, Mrs. J. Koch; Treasurer, Miss Elizabeth Rhodes.

The regular meetings of the League are held on the first and third Tuesday evenings of every month at the above address. Code practice for those who wish it is at 8 P. M., business meeting at 8:30 and the speech of the evening at 9:00.

At the meeting held on May 16, Mr. A. H. Hebert, an official of the American Radio Relay League and member of the Second District Executive Council, spoke on "Cooperation and Organization."

All women interested in radio are invited to attend these meetings and if desired, courses in radio telegraphy or telephony can be arranged for.

THE FRESNO RADIO CLUB

The radio fans of Fresno, California, at a recent radio mass meeting, organized a radio club to be known as The Fresno Radio Club, with a membership of 30. The club has established permanent headquarters at 1849 J St., Fresno, Calif., and has ordered a complete 10-watt phone and C.W. set which the members expect to have in operation within a short time, as well as one K.W. spark set. The station will be in operation every night during the week under a regular schedule and it is hoped to make Fresno one of the leading relay points in California.

The club will be glad to hear from other radio organizations throughout the Pacific coast with the purpose in view of establishing a dependable means of communication between Fresno and other Pacific coast cities. Please address all communications to Jas. R. Harding, President Fresno Radio Club, 1817 Tulare St., Fresno, Calif.

THE NORTH EASTERN COLORADO RADIO CLUB

The North Eastern Colorado Radio Club was organized Friday, April 14, 1922. The object of the club is to promote "The Study of the Theory and Operation of Radio Communication." We have 32 members at present, but expect to run over the one hundred mark soon. Meetings are held every Friday night at eight o'clock. The program consists of about 30 minutes of radiophone reception, followed by papers from different members of the club, or an outside speaker. After this, those interested have 30 minutes for code practice.

We have a splendid receiving set, consisting of a Type 110 Universal Regenerative Receiver with a three-step power amplifier. We intend to install a 100-watt C. W. transmitting set soon.

The North Eastern Colorado Radio Club has a splendid reference library, with all of the current radio magazines, and latest books.

The officers are as follows: H. T. Van Valkenburgh, president; Niel Curlee, vice-president; K. C. Morse, consulting engineer; C. A. N. Armstrong, secretary-treasurer.

We would be glad to communicate with any other radio club. Address all communications to C. A. N. Armstrong, 227 N. 2nd St., Sterling, Colo.

FARGO-MOORHEAD RADIO CLUB

The organization of the Fargo-Moorhead Radio Club was completed April 14, 1922, at the Fargo Commercial Club. The following were elected officers to serve one year: E. C. Reineke, president; Bertrum Wick, vice-president; K. M. Hance, secretary-treasurer.

After adopting a constitution, a set of traffic rules were approved, which will effectively control the operation of transmitting apparatus within the two cities so as to cause a minimum of interference with the radiophone broadcasts.

Bertrum Wick was appointed Traffic Manager and given the authority to enforce these rules.

The regular meetings will be held at the Fargo Commercial Club on the second and fourth Fridays of each month at 8 P. M.

Those desiring to communicate with the Club can do so by addressing the secretary, K. M. Hance, Box 245, Fargo, North Dakota.

THE FOREST RADIO CLUB

The Forest Radio Club of Forest Avenue High School, Dallas, Texas, was organized March 27 with 55 charter members. The membership is now 75 and at special meetings there have been as many as 100 present. Our officers are Robert Glass, 5MJ, president; Charles Baker, vice-president; Sam Terranella, secretary-treasurer; Nerome Neisler, sergeant-at-arms; and Manuel Yonack, publicity agent. The purpose of the club is to further the knowledge of radio among its members. The club was organized and owes much of its knowledge of radio to Mr. Gray Moore, chemistry teacher of the school and owner of a three-stage set. With the aid of this set and a Magnavox, the club gave a radio concert to the entire school body which numbers 1,400. This is probably the largest body that has heard a radio concert in the Southwest. The concert was sent out by WRR, the local broadcasting station. The club meets every Monday afternoon and on the other four school days, a code practice is held for 30 minutes after school. Since its organization the club has advanced from the study of the crystal set to vacuum tube sets and transmitting sets and hopes to do better next fall.

Fading

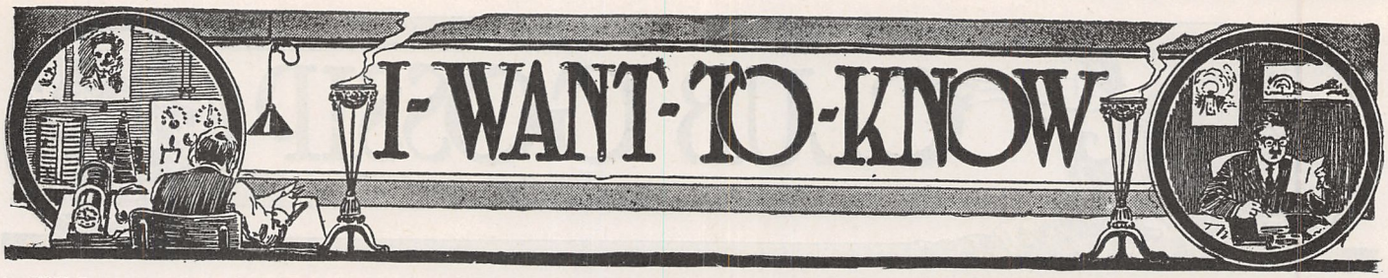
By RAYMOND B. BLOCK

ABOUT two years ago the Bureau of Standards carried out some fading tests, the object of which was to get some information which might ultimately lead to the discovery of the cause of fading. Except for a few articles published in "Q. S. T" and one paper published by the Bureau of Standards, nothing ever resulted from the tests. Even in the papers mentioned no serious attempt to explain the cause of the phenomenon was made. For the most part, they merely discussed the results of the tests and left the reader to draw his own conclusions. In this paper I shall try to show that fading is in full accordance with the most modern ideas of wireless transmission.

I think that fading is caused by the refraction of the radio waves upon entering a cloud or a fog bank. I say refraction and not reflection because the fading tests disclose that the waves are not reflected. Since wireless waves and light waves differ, as far as is known, only in their lengths, it is reasonable to assume that they are governed by the same physical laws. Long light waves are refracted least, and short light waves are refracted most, but the amount of their reflection does not depend upon their lengths. The tests evidence that long wireless waves fade least, and short wireless waves fade most. If fading were caused by the reflection of the radio waves, they all would fade equally. Upholding the theory that clouds cause the refraction is their motion and the known difficulty of sending through a thick fog bank, which is nothing but a cloud near the ground. The refracting medium must move in order to produce the swinging of the signals. If it did not move, the signals would always be weak or would always be strong.

The tests show that fading is most erratic in New England and gradually decreases to the southwest. A good relief map of the United States east of the Mississippi reveals that the topography of New England is very mountainous and that the mountains decrease to the southwest until the Great Central Plain is reached, where there are no highlands at all. As air rises to pass over a mountain, it becomes colder. When this rise in temperature reaches a certain point, the water vapor in the air condenses and thus forms a cloud. Hence there must be more clouds where there are highlands than where there are no highlands, because the water vapor in the air in a mountainous place has more chances to condense than in a non-mountainous place; and by the same reasoning, there must be more clouds in a very mountainous place than in a not so mountainous place. This fact, and the one that New England is near the Atlantic Ocean, indicate that there are more clouds in New England and that they decrease to the southwest. Hence we should expect fading to be more erratic in New England and diminish to the southwest, because the refracting medium is more prevalent in New England and lessens in the direction already stated. The tests, as before mentioned, show

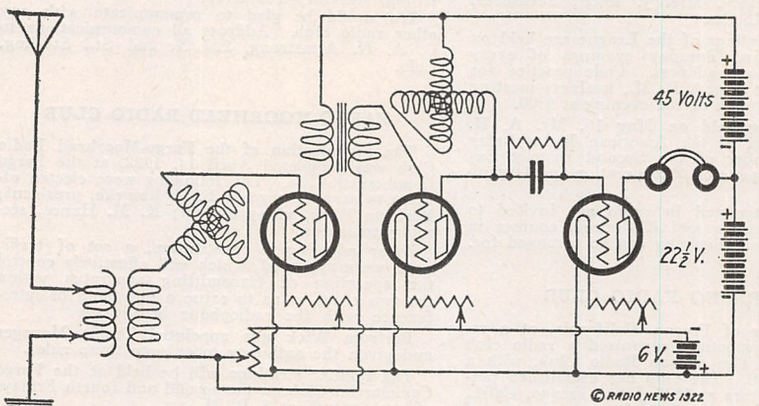
(*Continued on page* 173)



THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can only publish such matter of sufficient interest to all.

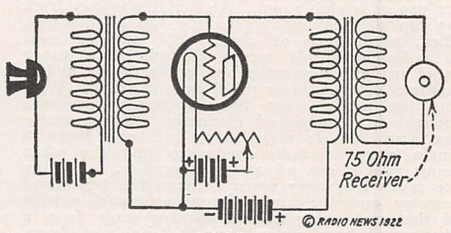
1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you will make your letter as brief as possible.



Q400

Two stages of radio frequency amplification are obtained with this circuit. The grid leak is incorrectly shown. It should be connected directly from the grid to the positive side of the filament.



Q 399

In this Circuit the Variations of the Microphone Current Are Amplified by a V. T. and Passed Through a Step-down Transformer to a 75-Ohm Receiver.

AMPLIFYING MICROPHONE CURRENT

(399) Mr. Earl R. Sanders, Warren, Ohio, wants to know:

Q. 1. Please show me how to connect up a microphone transmitter, using a 6-volt battery and V. T. so that I can amplify the microphone current.

A. 1. Diagram requested by you is published on this page. The microphone current is passed through a step-up transformer with a ratio of 50 to 1 and applied to the grid and filament of the vacuum tube. The output of the V. T. is connected through a step-down transformer to a 75-ohm receiver. The primary of the step-down transformer should have a resistance of 1,000 to 2,000 ohms and the secondary about 75 ohms.

RADIO FREQUENCY AMPLIFICATION

(400) Mr. R. K. Woodson, Liberty, Mo., asks:

Q. 1. Please publish hookup for a regenerative receiving set using two stages of radio frequency amplification, two stages of audio frequency and detector, all stages to use the same storage battery and plate battery.

A. 1. So many correspondents have asked this question, we will answer it in detail. Hookup is given in diagram at the bottom of this page. The diagram is divided into three sections to indicate the three divisions of the circuit. The tuner consists of the necessary inductances and condensers for tuning to the wave-length which it is desired to receive. The inductances may be in any suitable form—either a loose coupler with condensers or a variocoupler with variometers. Honeycomb coils may be used if desired. The condenser in series with the ground lead may be omitted and tuning accomplished by varying the inductance with taps alone. The aerial, ground and tuner may be substituted by a loop aerial shunted by a variable condenser, connected directly to the radio-frequency amplifier.

In the two-stage radio frequency amplifier, iron core transformers are used. This type of transformer is now on the market. Each transformer covers a limited band of wave-lengths, and amplification can only be obtained on wave-lengths within this range. If it is desired to receive and amplify on wave-lengths outside this range, different transformers must be used. Some types have convenient arrangements for plugging in other transformers. Another type short-circuits a portion of the turns to receive on lower wave-lengths. The potentiometer across the filament battery should be about 200 to 400 ohms resistance and is used to vary the potential on the grids of the two tubes in order that best advantage may be taken of the amplifying portion of the characteristic curve of these tubes. One rheostat is indicated to control the filament current of these two tubes. This is sufficient but two may be used if desired. The tubes used in the radio frequency amplifier should preferably be tubes with small internal capacity such as the A. P. or the RAC-3 Audion.

The detector and two stage amplifier is fairly familiar to most amateurs. The transformers are designed for amplification at audio frequency. The detector may be any type of soft detector tube which is not too critical; the amplifying tubes are of any make. The grid condenser and grid leak are variable according to the type of tube used; the two terminals in series with the plate circuit of the detector tube may be connected to a variometer or tickler coil for additional amplification by regeneration or these terminals may be shorted.

Another type of circuit employing two stages of radio frequency amplification in connection with a short wave regenerative receiver is indicated in the second diagram. Only one iron core radio frequency transformer is used; the output of the second tube is coupled to the detector tube by means of a condenser and a variometer is used to tune the plate circuit of the second tube.

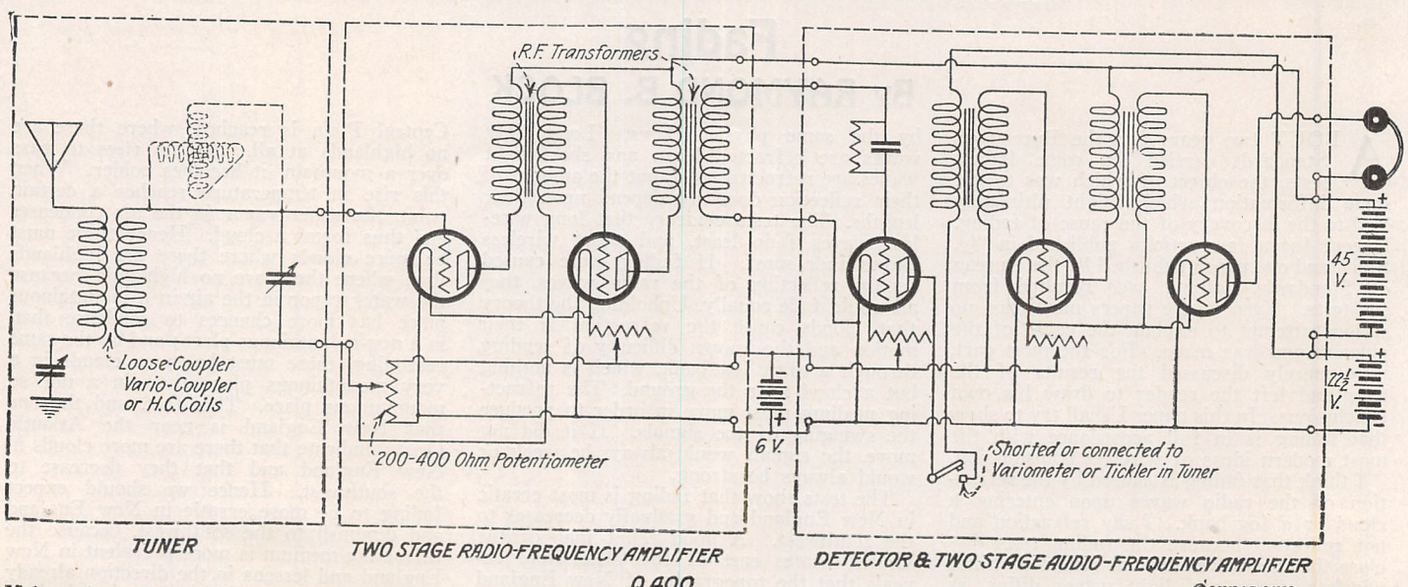
FRENCH TUBES FOR RADIO FREQUENCY AMPLIFICATION

(401) Mr. Robert Diehl, Defiance, Ohio, requests:

Q. 1. Please publish hookup for a loose coupler, two variometers, one step of radio frequency and one step of audio frequency with detector.

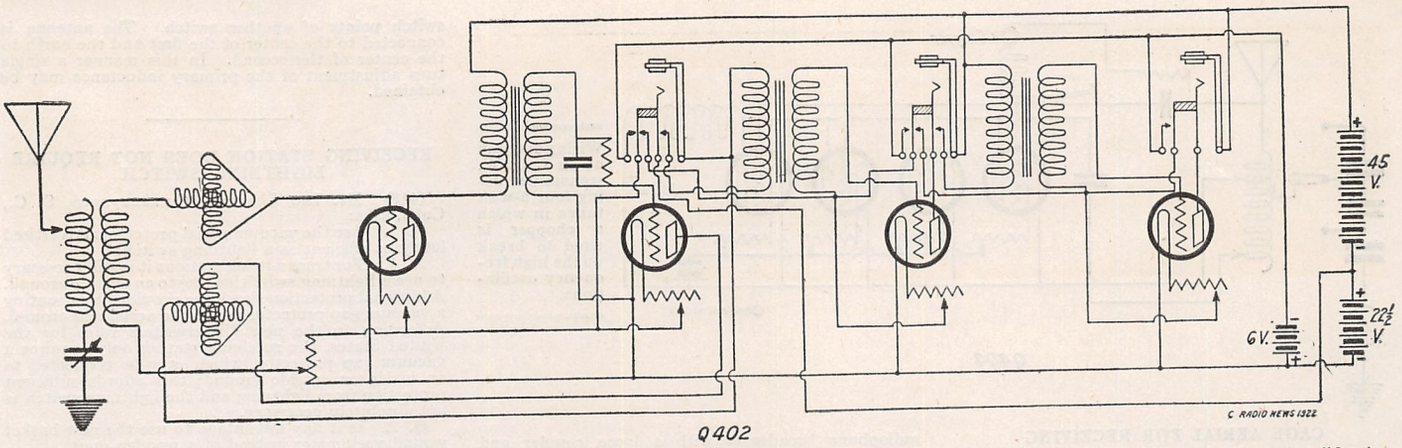
A. 1. The diagram of this circuit is given on the next page.

Q. 2. Which are best for this circuit, French tubes or Radiotrons, and where may French tubes be obtained?



Q 400

Make a Copy of This Circuit or Cut It Out and Keep It. It Is Very Sensitive and May be Used With a Loop Aerial by Disconnecting the Tuner and Connecting the Loop Directly to the Grid and Filament of the First Tube.



Q 402

This Shows How to Connect a Short Wave Regenerative Receiver Consisting of Variocoupler and Two Variometers to One Step of Radio Frequency Amplification, Detector and Two Steps of Audio Frequency Amplification Using Filament Control Jacks.

A. 2. Radiotrons may be used for the detector and audio frequency amplifier but French tubes will give better results in amplifying at radio frequency. These tubes may be obtained from the Mullard Radio Valve Company, Ltd., Clay Brook Road, Hammersmith, London, W6. They cost 15 shillings each in England and may be imported on the payment of about 20% duty.

AMPLIFIER WITH FILAMENT CONTROL JACKS

(402) Mr. Clayton E. Organ, Galion, Ohio, wants to know:

Q. 1. Will you kindly publish a good hookup of a set comprised of two variometers, variocoupler, condenser, etc., with one stage radio frequency amplification, detector and two stages of audio frequency amplification using automatic filament control jacks?

A. 1. Circuit requested by you is published on this page.

ADAPTING RECEIVER FOR RADIO FREQUENCY AMPLIFICATION

(403) Mr. Frank Wehman, Richmond Hill, New York, asks:

Q. 1. Please publish a hookup using two steps of radio frequency amplification in conjunction with Grebe CR5.

A. 1. Hookup you request is published. A Grebe, or other type of short wave regenerative receiver in which the detector tube is included in the same cabinet with the tuner, may be adapted for use with radio frequency transformers. This can be done by making the tube socket in the receiver contain the first amplifying tube. The grid condenser must be shorted or removed from the circuit and connection taken directly from the antenna condenser to the grid. The wire which connects the center of the inductance switch to the filament terminal on the tube socket should be disconnected and brought out to the center of a potentiometer as shown in the diagram. The output of the first amplifying tube (in the cabinet) is applied through a radio frequency transformer to the input of a second tube outside the tuner; the output of this tube is applied through another transformer to the input of the detector tube.

C. W. AND I. C. W. TRANSMITTER CIRCUIT

(404) Mr. Ervin A. Eichlom, Pearl River, New York, asks:

Q. 1. Please publish a hookup for a C. W. or I. C. W. set using four 5-watt tubes.

A. 1. Diagram requested by you is published on these pages. A motor-driven chopper is used to break up the high frequency oscillations. Condenser of 4 M. F. capacity should be connected across the high-tension source.

CRYSTAL AUDION SWITCH

(405) Mr. J. B. Findle, Detroit, Mich., wants to know:

Q. 1. Please publish a hookup with wave-lengths from 200 to 5,000 meters with switch to cut in either crystal detector or V. T. detector.

A. 1. This hookup is shown. A loose coupler may be used for tuning. The primary should be wound on a tube 4″ in diameter with about 300 turns and the secondary on a tube 3½″ in diameter with about 400 turns. The secondary should be tapped and shunted by a .001 M. F. condenser.

STORAGE BATTERY CHARGING CIRCUIT

(406) Mr. H. G. Siebins, Pekin, Ill., asks:

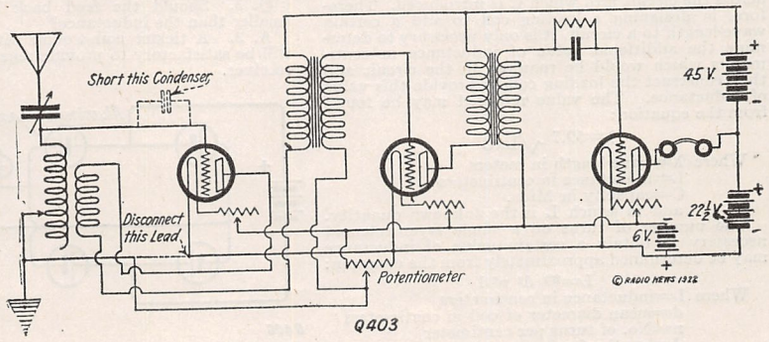
Q. 1. Please publish data of a rectifier for charging a storage battery.

A. 1. Diagram of the charging circuit is shown on next page. The size of the lead plates of this type of rectifier is 4″ by 6″. The aluminum plates may be the same size or slightly larger. The solution in the jars may be any one of the following:

Saturated solution of sodium phosphate,
" " " bicarbonate of soda,
10 per cent. " " sulphuric acid.
10 " " " hydrochloric acid.

Brine may also be used. The lamps in series parallel with the power line should pass about 2 amperes.

Some regenerative receivers have the detector tube in the same cabinet. A tuner of this description can be adapted for radio frequency amplification in the manner shown in this diagram.



Q 403

TYPES OF TUBES TO USE FOR VARIOUS PURPOSES

(407) Mr. John Morrow, Los Angeles, Calif., asks:

Q. 1. Please give me a hookup of a standard short wave regenerative receiver. Two stages of radio frequency and two stages of audio frequency amplification with detector.

A. 1. See answer to question 400.

Q. 2. What is the wave-length of an aerial fifty-five feet long, forty-five feet high, with four wires placed two feet apart?

A. 2. This antenna will have a natural wave-length of approximately 160 meters. The natural wave-lengths of aerials may be obtained from the charts published in this department in the April-May issue of RADIO NEWS.

Q. 3. Which of the following amplifier tubes do you consider the best for all-around work—A. P. Western Electric, Audiotron or Radiotron?

A. 3. A. P. are best adapted for radio frequency work; the Audiotron can only be used satisfactorily for detection purposes and the Western Electric or Radiotron are best suited for rectification or amplification at audio frequency.

SHIELDING RADIO FREQUENCY TRANSFORMERS

(408) Mr. George C. Chandler, Cereal, Alta., Can., wants to know:

Q. 1. If a radio frequency transformer was enclosed in a tin covering which in turn was grounded, would it prevent induction with other transformers and honeycomb coils?

A. 1. In the case of the radio frequency transformers in which an iron core is used it should not be necessary to shield in the manner you suggest. If an air core radio frequency transformer is used, the various stages must either be very widely spaced or some shielding arrangement made. The shield, however, must be perfect, or it will possess undesirable capacity effect.

Q. 2. Please publish a hookup of a one stage radio frequency amplifier and a detector, to be used in connection with a short wave regenerative set.

A. 2. The connections desired may be obtained from the diagram given in answer to question 401. If you do not wish to use the additional stage of audio frequency amplification, the third tube is omitted and the telephones connected in place of the primary of the audio frequency transformer.

CANNOT USE JACKS WITH RADIO FREQUENCY AMPLIFIER

(409) Mr. H. J. Meeder, Girard, Pa., asks:

Q. 1. Please publish a hookup for one, two and three steps of radio frequency amplifier, the number of stages variable by jacks.

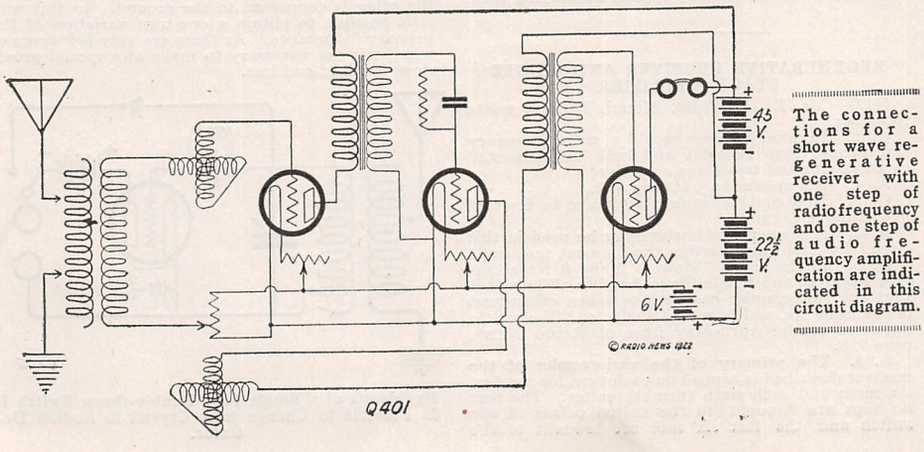
A. 1. Jacks cannot be used in the various stages of a radio frequency amplifier. The tubes and transformers amplify at radio frequency and rectification does not take place until these high frequency oscillations are impressed upon the detector tube. Since no rectification takes place before the detector tube, the telephones cannot be plugged in before the detector. The circuits you request may be found on these pages. Additional circuits showing the hookups for various combinations of radio frequency amplification may be obtained from the articles on this subject on pages 590 and 594 of the January, 1922, issue of RADIO NEWS.

HOW TO ELIMINATE STATIC

(410) Mr. Leonard Miller, Columbus, Nebraska, asks:

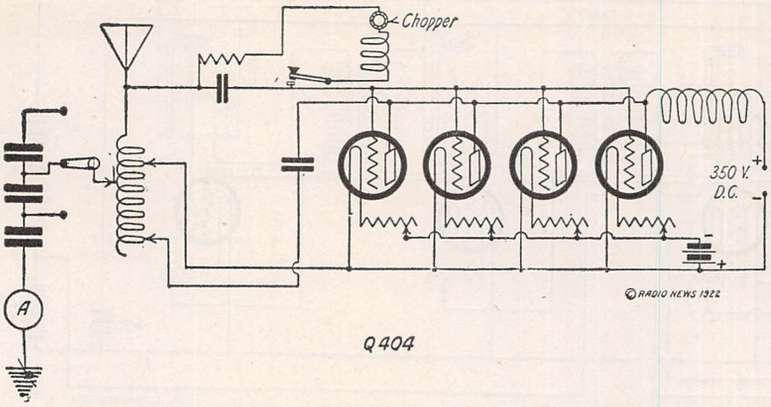
Q. 1. Is there any possible way of eliminating static from a receiving set while receiving concerts?

A. 1. The most effective and practicable way of reducing static interference is to use a loop aerial for reception with suitable amplification at radio frequency. Another method is to use a Beverage antenna, but the length of wire necessary for this antenna usually renders it impractical for amateurs. With an ordinary antenna and ground it is difficult to avoid static; a loose coupled regenerative receiver will, however, be less affected by static than the single circuit receiver; similarly, tuned radio frequency amplification will assist in reducing static.



Q 401

The connections for a short wave regenerative receiver with one step of radio frequency and one step of audio frequency amplification are indicated in this circuit diagram.



Q 404

Wiring diagram of an I. C. W. transmitter using four 5-watt tubes in which a chopper is used to break up the high frequency oscillations.

CAGE AERIAL FOR RECEIVING

(411) Mr. Russell Wightman, Gunnison, Colo., wants to know:

Q. 1. Is the cage aerial better than the flat top aerial for reception?

A. 1. It is our opinion that there is no advantage in using a cage aerial for reception purposes. The inverted "L" type will give as good results. There is some advantage, however, in the use of a cage aerial for transmission, especially in C. W. transmission.

CONSTRUCTING A LOADING COIL

(412) Mr. Philip Eysman, New York, wants to know:

Q. 1. Please give instruction for the construction of a loading coil intended to add about one thousand meters.

A. 1. The inductance of a loading coil is measured in henries or in centimeters, a centimeter being the billionth part of a henry. The wave length of a coil is a variable quantity depending upon the capacity which is shunted across it. If there is no condenser across the coil, it possesses a certain wave length depending upon the distributed capacity of the coil itself. When the coil is introduced into a circuit, however, it adds considerably more than its own natural wave length, on account of the capacity across the circuit into which it is introduced. Therefore, in designing a loading coil to add a certain wave-length to a circuit, it is only necessary to determine the additional value of inductance in centimeters which would be required in the circuit and then construct the loading coil to provide this value of inductance. The value required may be found from the equation:

$$\lambda = 59.7 \sqrt{LxC}$$

Where λ=wave-length in meters
L=inductance in centimeters
C=capacity in Mfds.
and in which L is the unknown quantity.

The number of turns on a single layer solenoid necessary to obtain a certain value of inductance may be determined approximately from the equation:

$$L = \pi^2 d^2 n^2 l$$

Where L=inductance in centimeters
d=mean diameter of coil in centimeters
n=No. of turns per centimeter
l=length of coil in centimeters

N depends upon the thickness of the wire used and l is the unknown quantity of the equation.

Q. 2. How is a loading coil connected to a loose coupled circuit with condensers and crystal detector?

A. 2. Two loading coils would be required with any loose coupled circuit, one in series with the primary and the other in series with the secondary circuit. The secondary condenser should be shunted across both the loading coil and the secondary of the loose coupler.

Q. 3. Can this set receive radiophone signals and how far?

A. 3. Any radio receiver is capable of receiving radiophone transmission. With the exception of a few stations, however, radio broadcasts are transmitted on 360 meters and loading coils would therefore be unnecessary. The normal receiving range of a receiver with crystal detector is not over 40 miles.

ATTACHING LOOP TO AMPLIFIER

(413) Mr. Hyman Goodbody, Toledo, Ohio, wants to know:

Q. 1. What is the best hookup for a honeycomb coil set using variable condensers with one step of radio frequency, audion detector and one step of audio frequency amplification?

A. 1. The circuit given in answer to question 401 may be used. The second honeycomb coil takes the place of the secondary of the variocoupler and the grid variometer; the tickler honeycomb coil takes the place of the plate variometer.

Q. 2. How could I attach a loop aerial to this circuit?

A. 2. A loop may be used with this circuit by omitting the inductances entirely and connecting the loop directly to the grid and filament of the first tube. A variable condenser should be shunted across the loop

RECEIVING RADIOPHONE WITH LOOSE COUPLER

(414) Mr. W. J. Carnes, Johnstown, Pa., asks:

Q. 1. Can I use a loose coupler rated at 1200 meters wave-length to receive radio concerts with one or two steps of amplification? With my present aerial and crystal detector, I occasionally hear Pittsburgh concerts, 78 miles away, but very weak.

A. 1. It will be possible for you to receive the radiophone broadcasts with a loose coupler and audion detector. The majority of broadcasting stations transmit on 360 meters and you will be able to tune down to this wave-length with your loose coupler. The circuit to use was given in answer to Question 346, April-May issue of RADIO NEWS. You are obtaining good results with a crystal detector, as, with this type of detector, it is not usually possible to receive radiophone transmission farther than forty miles.

SINGLE CIRCUIT RECEIVER

(415) Mr. F. W. Farmer, Ancaster, Ontario, Canada, asks:

Q. 1. What distance will the given hookup receive?

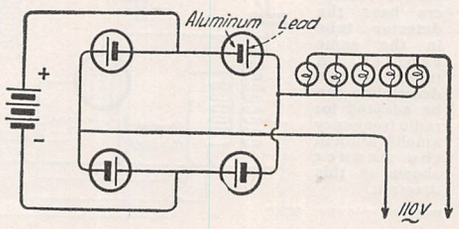
A. 1. Your hookup represents the standard single circuit regenerative receiver. Under good conditions it is usually possible to receive radiophone transmission about 200 miles with this type of receiver; conditions vary greatly, however, and it may be possible to receive much greater distances.

Q. 2. What is the wave-length range?

A. 2. This depends somewhat on the length of the antenna, but with a .001 M.F. condenser in series, and 180 turns on the inductance an approximate wave-length range of from 200 to 1000 meters should be obtained.

Q. 3. Should the feed back coil be larger or smaller than the inductance?

A. 3. A tickler coil wound with about 60 turns will be satisfactory to provide regeneration with this receiver.



Q 406

Diagram of the Circuit to Use for Charging a Storage Battery from 110 Volts A. C. With an Electrolytic Rectifier.

CHOKE COIL AMPLIFIERS

(416) Mr. Arthur Collins, Cedar Rapids, Iowa, wants to know:

Q. 1. Are choke coil amplifiers a proven success or are they in more or less of an experimental condition? I am planning a one step amplifier with which I want to obtain the best possible results. Would you advise the use of choke coils? If so please tell me the correct make of tube to use.

A. 1. A well-designed transformer will usually give better results than a choke coil for audio frequency amplification. A choke coil gives maximum efficiency over a limited range of audio frequencies only, but it does not provide the voltage amplification obtainable with a transformer. Good results, however, have been obtained with choke coil amplifiers and the construction cost is very low. Choke coils may be used with any type of amplifying tube.

REGENERATIVE RECEIVER AND SINGLE STAGE AMPLIFIER

(417) Mr. E. G. Watts, Miami, Florida, wants to know:

Q. 1. In what manner would a radio frequency transformer with rheostat and bulb be connected to a detector and two stage amplifier?

A. 1. See answer to question 402.

Q. 2. How could a filament voltmeter be inserted in the above circuit?

A. 2. A filament voltmeter may be used in this circuit by shunting it across the filament terminals.

Q. 3. In the article "How to Make A Regenerative Receiver and Single Stage Amplifier," how is it that the variocoupler has 12 taps taken off instead of the usual six, and how is this effected? The article appeared in the April-May issue of RADIO NEWS, page 938.

A. 3. The primary of the variocoupler of the receiver described is tapped on each turn for the first six turns and each sixth turn thereafter. The first six taps are brought to the switch points of one switch and the last six taps are brought to the switch points of another switch. The antenna is connected to the center of the first and the earth to the center of the second. In this manner a single turn adjustment of the primary inductance may be obtained.

RECEIVING STATION DOES NOT REQUIRE LIGHTNING SWITCH

(418) Mr. Leo Chanano, Cumanayagua, S. C., Cuba, asks:

Q. 1. Are the vacuum aerial protectors advertised lately as efficient as a lightning switch?

A. 1. For transmitting stations it is still necessary to use a lightning switch leading to an outside ground. Additional protection should be provided by shunting a vacuum gap protector across the aerial and ground. According to the new Underwriters rules for the United States, the receiving station only requires a vacuum gap protector, which may be connected to an inside or outside ground; this affords sufficient protection from lightning and the lightning switch is not absolutely necessary.

Q. 2. Is it any advantage to use the new basket wound variometer instead of a wooden one?

A. 2. In the reduction of distributed capacity effect the basket wound variometer is supposed to possess some advantage over the ordinary variometer wound on a wooden form.

Q. 3. Can I use enameled wire for variometer and variocoupler wiring instead of D.C.C. wire with equal efficiency?

A. 3. Enameled wire could be used, but D.C.C. wire of fairly large diameter will give better results as there will be less capacity between the turns.

RADIO OR AUDIO FREQUENCY AMPLIFICATION

(419) Mr. Dale Stoddard, Amos, Iowa, wants to know:

Q. 1. Please give me a hookup of a short wave regenerative tuner with one step of radio and two steps of audio frequency amplification.

A. 2. See answer to question 402.

Q. 2. Is this very much more satisfactory than three steps of audio frequency, which I have been using?

A. 2. You will find that the addition of one stage of radio frequency amplification will add considerably to the sensitivity of your receiver. You will be able to receive signals from greater distances and better selectivity will be obtained. Tube noises will also be reduced and possible howling eliminated.

Q. 3. Does radio frequency require 45 or more volts on the plate as does audio frequency?

A. 3. It is necessary to use at least 45 volts on the plates of tubes for amplifying at radio frequency. Greater amplification will be obtained with higher voltages and 60 volts is nearer the correct value.

LOOSE COUPLED OR SINGLE CIRCUIT RECEIVER

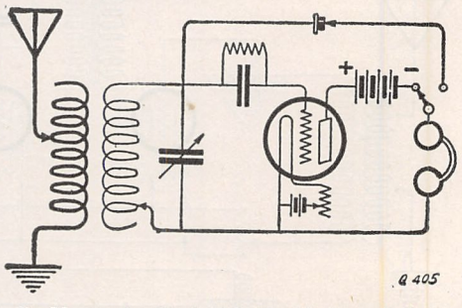
(420) Mr. H. E. Graham, St. Louis, Missouri, wants to know:

Q. 1. I want to use one stage of radio frequency amplification, detector and one stage of audio frequency amplification on my set and want to know if this can be wired for a regenerative effect.

A. 1. The circuit you require, showing a variometer in the plate circuit of the detector tube to furnish regeneration, is given in answer to Question 401.

Q. 2. To obtain the best results on short wave phone receiving, I want to use the most efficient hookup for phone work and use the honeycomb coils for long waves. Please state if the variocoupler is the best I could use for phone receiving on this set and how should I wind it for the best results with as little dead-end loss as possible.

A. 2. A variocoupler will give very good results on the short waves on which radiophone transmission is made. The circuit given in answer to Question 401 shows variocoupler with variometer in the grid circuit of the first tube to tune this circuit. Very good results are obtained in this manner, as the capacity of the circuit is kept at a low value and the inductive coupling between primary and secondary circuits can be made very loose. The variocoupler primary may be wound with 36 turns of No. 22 D. C. C. The first six turns should be brought to the switch points of one switch and each fifth turn thereafter brought to the switch points of another switch. The middle of one switch is connected to the antenna and the middle of the other is connected to the ground. In this way it is possible to obtain a one-turn variation of the primary inductance. As there are very few turns of wire, it is not necessary to make any special provisions for dead-end loss.



Q 405

By Means of a Single Pole Double-throw Switch It Is Possible to Change from Crystal to Audion Detector.

List of Stations Broadcasting Market or Weather Reports (485 Meters) and Music, Concerts, Lectures, Etc. (360 Meters)

Owner of Station	Location of Station	Wave Lengths	Call Signal
Alabama Power Co	Birmingham, Ala	360	WSY
Allen, Preston D	Oakland, Calif	360	KZM
Altadena Radio Laboratory	Altadena, Calif	360	KGO
American Radio & Research Corporation	Medford Hillside, Mass.	360	WGI
Atlanta Constitution	Atlanta, Ga	360, 485	WGM
Atlanta Journal	do	360, 485	WSB
Atlantic-Pacific Radio Supplies Co	Oakland, Calif	360	KZY
Bamberger & Co., L	Newark, N. J	360	WOR
Bible Institute of Los Angeles	Los Angeles, Calif	360	KJS
Church of the Covenant	Washington, D. C	360	WDM
Chicago, city of	Chicago, Ill	360	WBU
Clark University	Worcester, Mass	360, 485	WCN
Columbia Radio Co	Youngstown, Ohio	360	WMC
Continental Electrical Supply Co	Washington, D. C	360	WIL
Cosradio Co	Wichita, Kans	360, 485	WEY
Cox, Warren R	Cleveland, Ohio	360	WHK
Crosley Manufacturing Co	Cincinnati, Ohio	360	WLW
Daily News Printing Co	Canton, Ohio	360	WWB
Dallas, city of	Dallas, Tex	360, 485	WRR
DeForest Radio Telephone & Telegraph Co	New York, N. Y	360	WJX
Detroit News	Detroit, Mich	360, 485	WWJ
Detroit Police Department	do	360	KOP
Doerr-Mitchell Electrical Co	Spokane, Wash	360	KFZ
Doron Brothers Electrical Co	Hamilton, Ohio	360	WRK
Doubleday-Hill Electrical Co	Pittsburgh, Pa	360	KQV
Do	Washington, D. C	360	WMU
Duck Co., William B	Toledo, Ohio	360	WHU
Dunn & Co., J. J	Pasadena, Calif	360	KLB
Electric Equipment Co	Erie, Pa	360	WJT
Electric Lighting Supply Co	Hollywood, Calif	360	KGC
Electric Power & Appliance Co	Yakima, Wash	360	KQT
Emporium, The	San Francisco, Calif	360	KSL
Erie Radio Co	Erie, Pa	360	WSX
Examiner Printing Co	San Francisco, Calif	360	KUO
Fair, The	Chicago, Ill	360	WGU
Federal Institute of Radio Telegraphy	Camden, N. J	360	WRP
Federal Telephone & Telegraph Co	Buffalo, N. Y	360, 485	WGR
Ford Motor Co	Dearborn, Mich	360	WWI
Fort Worth Record	Fort Worth, Tex	360	WPA
Foster-Bradbury Radio Store	Yakima, Wash	360	KFV
General Electric Co	Schenectady, N. Y	360	WGY
Gilbert Co., A. C	New Haven, Conn	360	WCJ
Gimbel Brothers	Philadelphia, Pa	360	WIP
Gould, C. O	Stockton, Calif	360	KJQ
Hallock & Watson Radio Service	Portland, Oreg	360	KGG
Hamilton Manufacturing Co	Indianapolis, Ind	360	WLK
Hatfield Electric Co	do	360	WOH
Hawley, Willard P., Jr	Portland, Oreg	360	KYG
Herrold, Charles D	San Jose, Calif	360	KQW
Hobrecht, J. C	Sacramento, Calif	360	KVQ
Howlett, Thomas F. J	Philadelphia, Pa	360	WGL
Hunter, L. M., and G. L. Carrington	Little Rock, Ark	360	WSV
Hurlburt-Still Electrical Co	Houston, Tex	360, 485	WEV
Interstate Electric Co	New Orleans, La	360	WGV
Iowa Radio Corporation	Des Moines, Iowa	360	WHX
J. & M. Electric Co	Utica, N. Y	360	WSL
K. & L. Electric Co	McKeesport, Pa	360	WIK
Karlowa Radio Co	Rock Island, Ill	360, 485	WOC
Kennedy Co., Colin B	Los Altos, Calif	360	KLP
Kierulff & Co., C. R	Los Angeles, Calif	360	KHJ
Kluge, Arno A	do	360	KQL
Kraft, Vincent I	Seattle, Wash	360, 485	KJR
Lindsay-Weatherill & Co	Reedley, Calif	360	KMC
Love Electric Co	Tacoma, Wash	360	KMO
Loyola University	New Orleans, La	360	WWL
Maxwell Electric Co	Berkeley, Calif	360	KRE
May (Inc.), D. W	Newark, N. J	360	WBS
McBridge, George M	Bay City, Mich	360	WTP
McCarthy Bros. & Ford	Buffalo, N. Y	360	WWT
Metropolitan Utilities District	Omaha, Nebr	360, 485	WOU
Meyberg Co., Leo J	Los Angeles, Calif	360, 485	KYJ
Do	San Francisco, Calif	360, 485	KDN
Midland Refining Co	El Dorado, Kans	485	WAH
Do	Tulsa, Okla	485	WEH
Missouri State Marketing Bureau	Jefferson City, Mo	485	WOS
Montgomery Light & Power Co	Montgomery, Ala	360, 485	WGH
Mulrony, Marion A	Honolulu, Hawaii	360	KGU
Newspaper Printing Co	Pittsburgh, Pa	360	WPB
Noggle Electric Works	Monterey, Calif	360	KLN
Northern Radio & Electric Co	Seattle, Wash	360	KFC
Northwestern Radio Manufacturing Co	Portland, Oreg	360	KGN
Nushawg Poultry Farm	New Lebanon, Ohio	360	WPG
Oklahoma Radio Shop	Oklahoma City, Okla	360, 485	WKY
Oregonian Publishing Co	Portland, Oreg	360	KGW

REGULATIONS PERTAINING TO THE RADIO BROADCASTING OF WEATHER, CROP AND MARKET INFORMATION

1. Forecasts, warnings, and weather reports issued by the Weather Bureau and crop and market reports issued or approved by the Bureau of Markets and Crop Estimates shall be broadcasted only from radio stations authorized and licensed to do so by the Bureau of Navigation, Department of Commerce.

2. Broadcasting of weather forecasts and information and crop and market reports shall be confined to radio stations properly equipped for the work and operated by persons holding a commercial second-class or a higher grade of license.

3. No plant will be licensed by the Bureau of Navigation to disseminate weather forecasts and information or crop and market reports, except on the approval of the Chief of the Weather Bureau and of the Chief of the Bureau of Markets and Crop Estimates, respectively.

4. The call letter and location of the station and the official authenticity of the information shall be announced preliminary to each broadcast, and is approximately as follows:

This is.....located at.....

..... The weather forecast and reports issued by the U. S. Weather Bureau are as follows; or, market and crop reports, approved by the Bureau of Markets and Crop Estimates, are as follows:

5. The laws pertaining to the issuance of weather forecasts shall be observed. Violators of the following law will be prosecuted.

SEC. 61. Whoever shall knowingly issue or publish any counterfeit weather forecast or warning of weather conditions falsely representing such forecast or warning to have been issued or published by the Weather Bureau, United States Signal Service, or other branch of the Government service, shall be fined not more than five hundred dollars, or imprisoned not more than ninety days, or both. (Act of March 4, 1909, C 321, 35 Stat., 1088.)

6. All broadcasts shall be according to schedules approved by the Weather Bureau or by the Bureau of Markets and Crop Estimates. No forecasts based on a. m. observations shall be broadcasted after 7 p.m. of the same day; no special warnings based on special observations shall be broadcasted after midnight of the same day; and no forecasts or warnings based on p. m. observations shall be sent after 7 a. m. of the succeeding day, 75th meridian time applying in all cases.

7. Stations authorized to broadcast official weather forecasts and information and crop and market reports will use a wave-length of 485 meters unless otherwise licensed to do so by the Bureau of Navigation, Department of Commerce. This special wave-length shall be used for no other purpose.

8. License to broadcast weather forecasts and information and crop and market reports shall be revocable at any time that it may be in the public interest to do so.—*Submitted by Department of Agriculture.*

RADIO BROADCASTING

At the present time two wave-lengths are assigned for broadcasting—the wave-length of 485 meters for Government reports, such as crop and market estimates and weather forecasts furnished by the Department of Agriculture; the wave-length of 360 meters for important news items, entertainment, lectures, sermons, and similar matter.

Stations conducting this service must have limited commercial licenses and be operated by radio operators licensed by the Department of Commerce holding commercial second-class licenses or higher.

Applications for licenses should be made

through the radio inspector of the district in which the station is situated.

The radio inspection districts are as follows:

1. Headquarters, Boston, Mass. (radio inspector, customhouse): Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.

2. Headquarters, New York, N. Y. (radio inspector, customhouse): New York (County of New York, Staten Island, Long Island, and counties on the Hudson River to and including Schenectady, Albany, and Rensselaer) and New Jersey (Counties of Bergen, Passaic, Essex, Union, Middlesex, Monmouth, Hudson, and Ocean).

3. Headquarters, Baltimore, Md. (radio inspector, customhouse): New Jersey (all counties not included in second district), Pennsylvania (counties of Philadelphia, Delaware, all counties south of the Blue Mountains, and Franklin County), Delaware, Maryland, Virginia, District of Columbia.

4. Headquarters, Savannah, Ga. (the work of this district is being performed by the radio inspector of the third district, customhouse, Baltimore, Md.): North Carolina, South Carolina, Georgia, Florida, Porto Rico.

5. Headquarters, New Orleans, La. (radio inspector, customhouse): Alabama, Mississippi, Louisiana, Texas, Tennessee, Arkansas, Oklahoma, New Mexico.

6. Headquarters, San Francisco, Calif. (radio inspector, customhouse): California, Hawaii, Nevada, Utah, Arizona.

7. Headquarters, Seattle, Wash. (radio inspector, 2301 L. C. Smith Building): Oregon, Washington, Alaska, Idaho, Montana, Wyoming.

8. Headquarters, Detroit, Mich. (radio inspector, Federal Building): New York (all counties not included in second district), Pennsylvania (all counties not included in third district), West Virginia, Ohio, Michigan (lower peninsula).

9. Headquarters, Chicago, Ill. (radio inspector, Federal Building): Indiana, Illinois, Wisconsin, Michigan (upper peninsula), Minnesota, Kentucky, Missouri, Kansas, Colorado, Iowa, Nebraska, South Dakota, North Dakota.

INTERFERENCE BY BROADCASTING STATIONS

Broadcasting stations should shut off transmitters when not in actual operation to prevent unnecessary interference from carrier wave.

Care should be taken not to extend schedules resulting in interference with the schedules of other stations.

Transmitters must be adjusted so as not to produce unnecessary interference. It has come to the attention of the bureau that some stations have interfered over a band of from 200 to 500 meters which may be reported as a violation of the law.

RADIO ANNOUNCER'S VOICE BROADCASTED FROM KDKA RECORDED BY DICTAPHONE AT DISTANT POINT

It is not often that a man's voice is returned by parcel post, but such was the unusual experience of H. W. Arlin, announcer at KDKA, the East Pittsburgh radio telephone broadcasting station.

On April 5, Mr. Arlin was on duty at KDKA and, in addition to announcing the musical program, gave out the news and talks on his schedule. The same evening W. E. Weaver, of Hespeler, Ontario, several hundred miles north of East Pittsburgh, Pa., was listening in on his radio receiver. Struck by a happy thought, he wheeled a dictaphone in front of his loud speaker and registered part of the concert on the record.

This record he sent to the radio department with an invitation to listen to it and see how KDKA is received in Ontario. It is unnecessary to say that everybody connected with the radio division at various times put the head-piece over his ears to hear the canned wireless.

Owner of Station	Location of Station	Wave Lengths	Call Signal
Palladium Printing Co	Richmond, Ind	360, 485	WOZ
Paris Radio Electric Co	Paris, Tex	360	WTK
Pine Bluff Co	Pine Bluff, Ark	360	WOK
Pomona Fixture & Wiring Co	Pomona, Calif	360	KGF
Portable Wireless Telephone Co	Stockton, Calif	360	KWG
Post Dispatch	St. Louis, Mo	360	KSD
Precision Equipment Co	Cincinnati, Ohio	360, 485	WMH
Precision Shop, The	Gridley, Calif	360	KFU
Radio Construction & Electric Co	Washington, D. C.	360	WDW
Radio Corporation of America	Roselle Park, N. J.	360	WDY
Radio Telephone Shop, The	San Francisco, Calif	360	KYY
Radio Shop, The	Sunnyvale, Calif	360	KJJ
Register & Tribune, The	Des Moines, Iowa	360	WGF
Reynolds Radio Co	Denver, Colo	360, 485	KLZ
Ridgewood Times Printing & Publishing Co	Ridgewood, N. Y.	360	WHN
Riechman-Crosby Co	Memphis, Tenn	360, 485	WKN
Rike-Kumler Co	Dayton, Ohio	360, 485	WFO
Rochester Times Union	Rochester, N. Y.	360, 485	WHQ
St. Louis University	St. Louis, Mo	485	WEW
St. Martins College (Rev. S. Ruth)	Lacey, Wash	360	KGY
San Joaquin Light & Power Corporation	Fresno, Calif	360	KMJ
Seeley, Stuart W	East Lansing, Mich	485	WHW
Service Radio Equipment Co	Toledo, Ohio	360	WJK
Ship Owners Radio Service	New York, N. Y.	360	WDT
Shotton Radio Manufacturing Co	Albany, N. Y.	360	WNJ
Southern Electrical Co	San Diego, Calif	360	KDPT
Southern Radio Corporation	Charlotte, N. C.	360	WBT
Strawbridge & Clothier	Philadelphia, Pa	360	WFI
Stubbs Electric Co	Portland, Oreg	360	KQY
Tarrytown Radio Research Laboratory	Tarrytown, N. Y.	360	WRW
Union College	Schenectady, N. Y.	360	WRL
United Equipment Co	Memphis, Tenn	360	WPO
University of Illinois	Urbana, Ill	360	WRM
University of Minnesota	Minneapolis, Minn	360, 485	WLB
University of Texas	Austin, Tex	360, 485	WCM
University of Wisconsin	Madison, Wis	360, 485	WHA
West Virginia University	Morgantown, W. Va	360	WHD
Wanamaker, John	Philadelphia, Pa	360	WOO
Do	New York, N. Y.	360	WWZ
Warner Brothers	Oakland, Calif	360	KLS
Wasmer, Louis	Seattle, Wash	360	KHQ
Western Radio Co	Kansas City, Mo	360, 485	WOQ
Western Radio Electric Co	Los Angeles, Calif	360	KOG
Westinghouse Electric & Manufacturing Co	East Pittsburgh, Pa	360	KDKA
Do	Chicago, Ill	360, 485	KYW
Do	Newark, N. J	360	WJZ
Do	Springfield, Mass	360	WBZ
White & Boyer Co	Washington, D. C	360	WJH
Williams, Thomas J	do	360	WPM
Wireless Telephone Co. of Hudson Co., N. J	Jersey City, N. J	360	WNO
Yeiser, John O., Jr	Omaha, Nebr	360	WDV
Young Men's Christian Association	Denver, Colo	485	KOA
Zamoiski Co., Joseph M	Baltimore, Md	360	WKC
SUPPLEMENTAL LIST FROM APRIL 1 TO APRIL 15, 1922			
Aldrich Marble & Granite Co., C. F	Colorado Springs, Colo	485	KHD
Anthony, Earl C	Los Angeles, Calif	360	KFI
Arrow Radio Laboratories	Anderson, Ind	360	WMA
Auburn Electrical Co	Auburn, Me	360	WMB
Beacon Light Co	Los Angeles, Calif	360	KNR
Benwood Co	St. Louis, Mo	360	WEB
Blue Diamond Electric Co	Hood River, Oreg	360	KQP
Braun Corporation	Los Angeles, Calif	360	KXS
Buckeye Radio Service Co	Akron, Ohio	360	WOE
Bush, James L	Tuscola, Ill	360	WDZ
Central Radio Co	Kansas City, Mo	360	WPE
City Dye Works & Laundry Co	Los Angeles, Calif	360	KUS
Commonwealth Electric Co	St. Paul, Minn	360	WAAH
Cooper, Irving S	Los Angeles, Calif	360	KZI
Eastern Radio Institute	Boston, Mass	360	WAAJ
Electric Supply Co	Clearfield, Pa	360	WPI
Elliott Electric Co	Shreveport, La	360	WAAG
Fergus Electric Co	Zanesville, Ohio	360	WPL
Findley Electric Co	Minneapolis, Minn	360	WCE
Gimbel Brothers	Milwaukee, Wis	360	WAAK
Groves-Thornton Hardware Co	Huntington, W. Va	360	WAAR
Herald Publishing Co	Modesto, Calif	360	KXD
Hollister-Miller Motor Co	Emporia, Kans	360	WAAZ
Holzwasser (Inc.)	San Diego, Calif	360	KON
Howe, Richard H	Granville, Ohio	360	WJD
Kansas State Agricultural College	Manhattan, Kans	485	WTG
Los Angeles Examiner	Los Angeles, Calif	360	KWH
Minnesota Tribune Co. and Anderson-Beamish Co	Minneapolis, Minn	360	WAAL
Modesto Evening News	Modesto, Calif	360	KOQ
Mullins Electric Co., Wm. A	Tacoma, Wash	360	KGB
Nelson Co., I. R	Newark, N. J	360	WAAM
New England Motor Sales Co	Greenwich, Conn	360	WAAQ
New Mexico College of Agriculture & Mechanical Arts	State College, N. Mex	360, 485	KOB
Prest & Dean Radio Research Laboratory	Long Beach, Calif	360	KSS
Purdue University	West Lafayette, Ind	360	WBAA

(*Continued on page* 178)

MURDOCK

radio necessities

MURDOCK
No. 56

2000 OHM COMPLETE DOUBLE SET $5.00

3000 OHM COMPLETE DOUBLE SET $6.00

MURDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis, for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noise, and the moulding of all parts into one durable unit

All models of Murdock receivers are sold with free trial offer and money back guarantee. Use them in direct comparison to any other phones for 14 days. Make any test you wish. Then, at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

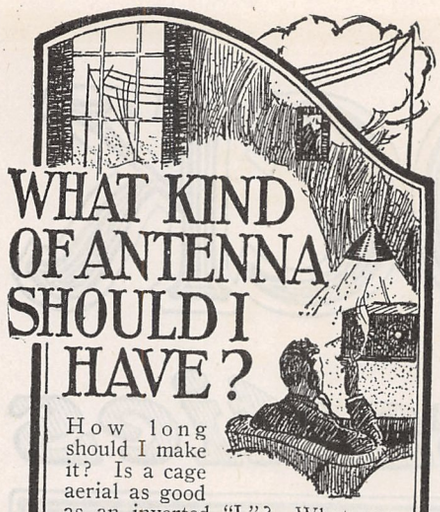
Many of the complete "ready-to-operate" wireless sets now on the market include Murdock Phones as standard equipment. If the set you buy does not, be sure you get a set of Murdock receivers to complete your station. We strongly urge you to go to your dealer and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. Prices $5.00 to $6.00.

Murdock Phones are the standard bearer for a complete line of "Made-by-Murdock" radio parts and instruments. This includes the famous Murdock condensers, and the new Murdock Rheostat at $1.00.

Buy Murdock Radio Apparatus
From Your Dealer

WM. J. MURDOCK CO.

Washington Ave., Chelsea, Mass.



WHAT KIND OF ANTENNA SHOULD I HAVE?

How long should I make it? Is a cage aerial as good as an inverted "L"? What are the latest developments in loop aerials? How can I build a good amplifier? What equipment will I need to receive longer wave lengths? How can I hook up my apparatus differently to get 50 per cent better results?

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Knows all—tells how

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The Pungs-Gerth System of Wireless Telephony

(*Continued from page* 50)

tem mainly consists of the variable resistance of the cathode tube being substituted for the variable resistance of the iron coil. The current feeding the tube which, in the antenna, sets up high frequency vibrations, is, by a special cathode tube connected up in series to the sending system proper, altered at the rhythm of human speech.

The experimental part of the lecture aroused especial interest, wireless transmissions of speech and music being made audible to an auditorium of about 300 in the large hall of the Technical High School, so as to produce a nearly perfect illusion of the speaker or musician being in the hall. This success was due to the combination of a novel loud-speaking telephone receiver with the Lorenz-Poulsen sender of the Königswusterhausen Wireless Station, equipped with the magnetic system above described. An antenna frame 1.5 meters square, suspended over the lecturer's desk, was used for receiving. A masterly violin concert formed part of the performance.

Notes on Radio in China

(*Continued from page* 27)

GOVERNMENT LEGISLATION ON AMATEURS

Like most Governments, the Chinese Government intends to be strict with regard to radio regulations. Private radio stations on Chinese territory are frowned at by the authorities and in many instances, they have had to be dismantled, causing the foreign consuls much inconvenience. However, Shanghai is an international settlement, the government being carried on by a Municipal Council, elected by the people of all nations, exclusive of Chinese. Under these conditions the Chinese Government has not attempted to exercise radio jurisdiction as to wave-lengths, power, etc. The amateurs of Shanghai, for the most part, would welcome legislation on the part of the Chinese Government, providing the rules were not too strict, for it would give the amateurs their own realm. The Chinese Government seems to be too busy running more important affairs and has not had time to enforce regulations on amateur wireless.

NOT MUCH AMATEUR TRANSMITTING

As a matter of fact, however, since there are no amateurs to send to outside of Shanghai, there has been very little transmitting on the part of amateurs. At present, the few who have powerful transmitters use pretty much whatever they please, as did the one mentioned in the beginning of this article.

Although the writer is informed that there are at present over 100 amateurs in Shanghai, they have never organized a club, but it is anticipated that such an organization will be formed in the near future. Such a radio club would be an innovation in the way of nationalities represented in that it would include Americans, British, French, Dutch, Portuguese, Chinese and possibly several others. It might be able to do a great deal toward putting amateur radio in China on a firm basis.

HALF A YARD SQUARE

Herewith is published a picture of the permit which the writer had to obtain at the cost of $1.50 in cash and about $100 worth of time and energy chasing around, in order to import three variable condensers. Can any of the readers pick out the exact characters which say "variable condensers"?

FROM COAST TO COAST

Because of its central location, Shanghai is an admirable place from which to cover the

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A KLEIN SUPER PRODUCT

A sturdy crystal detector mounted on a high-grade moulded hard rubber base, parts of solid brass highly nickel plated, with Condensite handle knob.

It has a fixed Condenser of .002 Micro Farad capacity incorporated in the base and is furnished complete with a famous KLEIN AMPLISITE Crystal mounted in Wood's Metal.

Internally wired and arranged with binding posts for receivers and ground.

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No 103—Tuning Coil, 260 Turns of No. 22 Enameled Wire and Patented Roller Bearing Sliders 3.00

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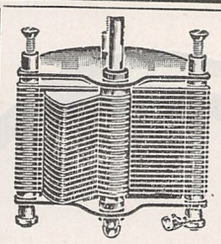

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The Concert Was 1100 Miles Away

Colorado Springs, 2-28-'22.

"About three weeks ago I purchased a Clapp-Eastham H. R. Receiving Set from the Reynolds Radio Company . . . I know nothing about radio, and this is my first receiving set. When Reynolds told me that under good conditions he had heard San Francisco from Denver, I was rather skeptical.

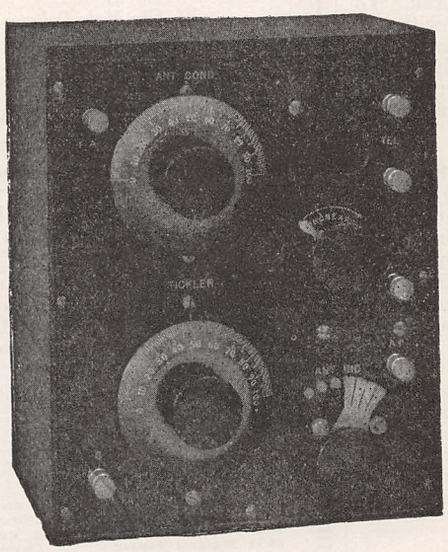
"However, last Friday night, I happened to pick up a concert of the Detroit Symphony Orchestra sent out by the Detroit News. Toward the latter part of the entertainment . . . the music and announcements came so clearly that we could understand perfectly with *only one phone*.

"The fact that Detroit is about *eleven hundred miles* from here in a straight line, seems so incredible that I wired Detroit to verify the facts. Since then we have gotten Detroit three times. I was not using an amplifier."

J. H. P. (Name on request)

WE have specialized exclusively in radio for more than fourteen years. Every one of those years has contributed something important to our latest Type H. R. Regenerative Receiving Set. We sincerely believe it to be the best set of this type on the market today—regardless of price.

Novices and experienced radio men alike praise its simplicity of operation, its sharp, clear tones, its wide range, its careful workmanship, its neat appearance. And invariably they express surprise at its unexpected performance. Regenerates perfectly wave lengths of 180 to 825 meters.



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N. B. If, owing to the phenomenal demand, your dealer is out of Clapp-Eastham sets, write us. 6c stamps will bring you our new Radio Catalog—containing full information regarding this set and other radio equipment. Clapp-Eastham Co., 139 Main Street, Cambridge, Mass. *Oldest and Largest Exclusive Makers of Radio Equipment.*

SPECIFICATIONS

Cabinets: Solid mahogany, dull finish.

Panel: Condensite, dull finish, machine engraved, white lettering.

Dials: Indestructible metal, black with white lettering.

Condenser: Balanced type, built as a Vernier; 2 rotary, 3 stationary plates.

Antenna Inductance: Wound on formica tube.

Plate Inductance: Wound on molded ball.

Binding Parts: Black rubber covered.

Switch: Fan blade.

Rheostat: Clapp-Eastham type H 400.

Circuit: Single circuit regenerative.

"B" Battery: Contained in inside compartment or external, as desired.

Price: $40.

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Type HR

Regenerative Receiving Set

Use Nothing But the Best

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If your dealer can't supply you, write us for names of nearby dealers who can.

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No. 22 Enameled Magnet Wire, 35c lb. on full spools, (7 to 12 lb.). F. JOS. LAMB COMPANY, 1960 Franklin Street, Detroit, Michigan.

world by radio. It is a convenient thing to remember that London and Paris, Shanghai and Manila, and San Francisco are equidistant points around the world. European stations come in strong here, both large and small. Pacific Coast American stations also come in well. Even Atlantic Coast stations have been heard in Shanghai. It is a coincidence, and many of you may have heard, Pearl Harbor and Nauen sending time signals at the same time, one at noon and the other at midnight. Their wave lengths are such that they both can be heard at one adjustment. The air in Shanghai is practically free from static in winter, but in hot weather it is likely to be very heavy.

A short time ago the writer was astonished to hear perfectly good Peking Chinese language floating around the ether. "The ole world do move!" He was interested to read in a recent number of RADIO NEWS that Chinese was "just a gurgle." If it is in life a gurgle, over a wireless phone it's a strangling performance.

Nanyang College, at Shanghai, one of the leading Chinese technical schools of the country, has instituted a course in Radio Engineering. They have been fortunate enough to secure the services of Mr. T. C. Chang, an American trained radio engineer, who, as head of the department, is rendering great service to radio in China. At present there are about 20 students taking up this line. It is a full-fledged engineering course, not merely a school for operators.

One of the most interesting radio enterprises in China has been the popular educational movement under the direction of Prof. C. H. Robertson of the Lecture Department of the Y. M. C. A. He purchased, while in America a short time ago, the two complete radio telephone stations which were used in the Victory Way in New York City during the Victory Loan drive. These he has cleverly mounted in trunks, so that in a few minutes' time, the two stations can be set up for lecture purposes. On one tour of about 12 cities, 100,000 people heard him speak. To see some old Chinese Governor with the phones clamped to his ears, as interested as a kid, is a sight to make one think that China has got to wake up. He has given lectures to the leading generals of the country and even before the President of the Republic himself.

It would not be surprising if China was one of the first countries in the world to establish a satisfactory commercial network of wireless telephones, because land lines have never been installed. Because of the great distances to be covered and the difficulty of procuring land even to plant telephone poles, the wireless telephone may solve one of the greatest communicational difficulties between China's 1,900 walled cities.

Who knows but what in a few years from now, Americans in Shanghai will be sitting down to breakfast with the strains of the Metropolitan Opera Company concert, of the evening following, floating through the house? Sounds rather nice, doesn't it?

A Celestial Audion

(*Continued from page* 41)

terior planets. Here the expert steps in and says that it is impossible for our radio waves ever to leave the earth, due to the so-called heavy-side layer. It is our opinion that the heavy-side layer presents no great obstacle for radio waves. It is our firm belief that the thin blanket of air only measuring about 30 miles is not sufficient to stop the radio waves, even though our experts may tell us that the upper layers of the atmosphere of the earth are constantly ionized. It is our belief that our atmosphere is no thicker in proportion than the gases adhering to the surface of the grid or plate, and perhaps vastly less.

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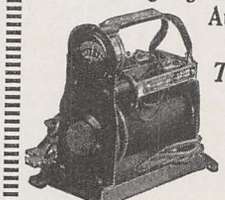

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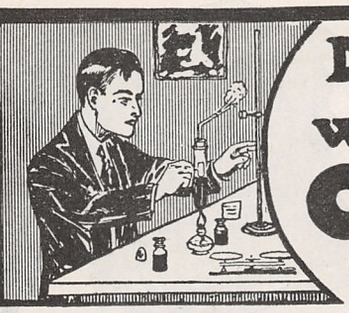

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"This is something which has long been needed. Your long experience in the teaching of chemistry . . . assurance that the course will be practical as well as plain to the untrained students."

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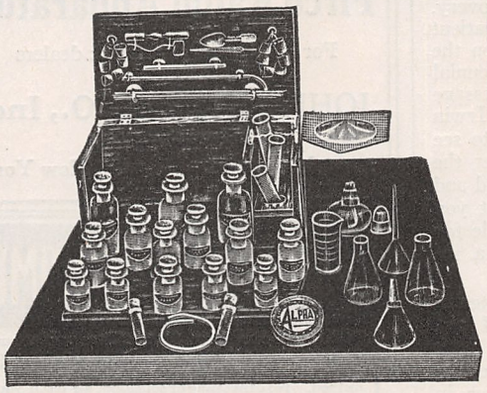

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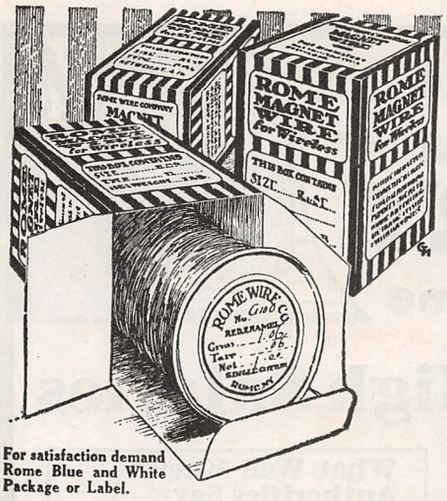

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All sizes: ¼- lb. to 40-lb. packages.

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THE WOLF AERIAL

Eliminate All Outside and Inside Wires

Attach the Wolf Aerial to any electric light socket in the home or office and get the best results from your Radio Receiving Set. Fool proof and no danger. It comes ready to use; just screw into light socket and connect to aerial post of set. Save cost of aerial construction and lightning switches. Guaranteed to give good results. **Order today. Price, $3.50 postpaid. ($4.00 west of Rockies.)**

WOLF RADIO CO.
208R Scherer Bldg., Detroit, Mich.
Dealers and Agents wanted.

RADIO DEALERS AND MANUFACTURERS

We have them—all parts needed for the radio trade promptly delivered.
Send us your requirements for prices

SMITH ENGINEERING CO.
One Union Square New York City

and plate as well. Does this make electronic flow impossible? Certainly not! The diameter of the earth is 8,000 miles and the film of air on the surface—our atmosphere—is 30 miles thick. It is almost certain that the layer of gas on the plate of an audion is greater in proportion than the atmospheric layer on the earth.

Physicians at Sea Give Diagnosis by Radiophone

(*Continued from page 41*)

surgeon on the Steamship "Centennial State," which plies between New York and London. Some nine years ago Dr. Irwin, then serving on a vessel plying between New York and Central American ports, was summoned to the wireless room one day and informed that the keeper of a lighthouse on a lonely island in the Caribbean was suffering as a result of an injury to his leg, and that immediate medical attention was necessary. The island had five persons as its population, this being the lighthouse tender, his wife, a wireless operator and two other workmen, one of whom acted as cook. Dr. Irwin asked for a complete history of the case, and across 800 miles of sea the details were given him in dots and dashes. The lighthouse keeper had fallen, broken a leg, and gangrene had developed. From the facts provided him Dr. Irwin came to the conclusion that an immediate amputation was necessary to save the life of the sufferer. It was out of the question for the ship to get to the island, for the surgeon well realized that the time consumed would be too great. He inquired whether or not the others on the island would be willing to attempt the necessary amputation, provided he gave them specific directions. Receiving an answer in the affirmative, Dr. Irwin detailed through the ether the process necessary for the taking off of the injured man's limb. The surgical portion of the operation was performed by the cook, using as his instruments a butcher knife and a kitchen saw. Inasmuch as no anaesthetics were available, the injured man had to grin and bear it, but fainted before the operation was concluded. During the next two or three days Dr. Irwin received wireless communications regarding the state of the patient and found that he was doing well, having a robust constitution. Several months thereafter, when Dr. Irwin's vessel was within wireless talking distance of the island, he communicated with his patient and found that he was well on the road to recovery. Only a few weeks ago Doctor and patient met for the first time, and that was on the arrival day of the Steamship "Centennial State" in the Port of New York. A message that came from the pier informed Dr. Irwin that a gentlemen with one leg desired to see him. When Dr. Irwin reached the pier the one legged man grasped him by the hand and said "Doctor, you don't know me, but you ought to, inasmuch as you are responsible for taking off my leg." Then followed a rehashing of the historic case.

Recently Dr. W. S. Ford, of the Steamship "Potomac" of the United States Lines, aided and abetted the stork by wireless. Late one night Dr. Ford was aroused to read a message which came from a freighter in mid-Atlantic which read as follows: "Captain's wife on board. Expect arrival of stork before we can reach port. Please assist." This was a stumper for the doughty Doctor, but it was an emergency and he could not fail. He therefore detailed in language that could be understood by a layman the necessary directions to the far-off freighter over which the stork hovered. Two days late Dr. Ford received another message which read: "Now have a new son. Don't know your name, Doctor, but will call him Napoleon

$3 DOWN brings genuine

UNDERWOOD

Yes, only $3 down puts this genuine standard Shipman-Ward Rebuilt Underwood in your home. Then—small monthly payments, or if convenient, pay cash. Either way you get the *world's standard* typewriter at a big cash saving.

WHY PAY RENTAL?

Think of it! You pay little more than rental, and the machine is yours! We offer the same three models of the Underwood Typewriter which are being made and sold by the Underwood Company today. The only difference is that Shipman-Ward machines are priced lower and are rebuilt like new by experts. You can't tell them from brand new machines. Visible writing—the FULL LINE of typewriting is visible at all times. STANDARD 4-ROW SINGLE SHIFT KEYBOARD. Two color ribbon, back spacer, stencil device, automatic ribbon reverse, tabulator, etc.

TEN DAYS' FREE TRIAL

See for yourself! Try the typewriter ten days. You must be satisfied or the entire transaction won't cost you a penny. Act today. Get our big illustrated catalog and full particulars. Write NOW.

FREE TRIAL COUPON

Typewriter Emporium
SHIPMAN-WARD MFG. CO.
B-195 Shipman Bldg., CHICAGO

Send by return mail Bargain Offer No. B-195 of a Standard Visible Writing Underwood. This is not an order and does not obligate me to buy.

Name.....
Street or R. F. D. No.....
Postoffice..... State.....

FIRCO RADIO

Firco Radio Apparatus

For sale by all prominent dealers

JOHN FIRTH & CO., Inc.
Pioneers since 1901
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MAKE MONEY AT HOME

YOU can earn from $1 to $2 an hour in your spare time writing show cards. Quickly and easily learned by our new, simple "Instructograph" method. No canvassing or soliciting; we teach you how, guarantee you steady work at home no matter where you live, and pay you cash each week.

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Write For Our FREE BOOKS On

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Tower Bldg.....CHICAGO, ILL.
611 Hanna Bldg.....CLEVELAND, O.
Hobart Bldg.....SAN FRANCISCO, CAL.

Ready July 1st **"Musio"** Ready July 1st.

TRADE MARK REG. U.S. PAT. OFF.

A NEW RADIO RECEIVING SET

With Patented Automatic Crystal Detector

Every Set Guaranteed!

Every "MUSIO" is guaranteed to give as good or better results than any other crystal set on the market, regardless of price.

$12.50

Newest Invention in Radio

"Musio" Automatic Crystal Detector

A slight turn of the knob picks out another "sensitive spot"—always at the correct pressure, insuring the sharp and clear reception of music, lectures and news.

The crystal detector is located inside the cabinet. It cannot collect dust. It cannot be tampered with nor damaged.

"Musio"

RECEIVING OUTFIT
Includes the "MUSIO"
and
Copperweld Antenna Wire
Copperweld rubber insulated Lead-in and Ground Wire
Antenna Insulators
Entrance Tube
Ground Clamp and Splicer

All packed in a token box with explicit directions for installing and wiring correctly in accordance with Underwriters' Rules.

Without Phones Complete for $12.50

RADIO DEALERS "Musio" offers you a big opportunity. Write today for particulars.

THE most efficient, low-priced receiving set ever devised. *Easily operated by a child.* Designed by the best engineering talent. The very highest quality of materials used throughout.

Beautifully built.

Finished in mahogany.

Musio Radio Co.
Westinghouse Building
Garrison Way and French St.
PITTSBURGH, PENN.

ELWOOD

RADIO HEADSETS

The seventeen years of practical experience in the making of telephones and receivers by this company assures you of good design and workmanship.

Elwood headsets meet the exacting demands of all purchasers of radio units and parts. Both receivers operate in unison, insuring clear, harmonious and uninterrupted reproduction. Our absolute guarantee of the ohmage capacity of these headsets is your safeguard.

Receivers have metal case, highly finished. Headbands have sanitary fabric covering, fully adjustable. Complete set packed in attractive carton.

We are also manufacturers of Binding Posts, Contact Points, Jacks and Plugs for Radio Work.

Elwood Electric Co., Inc.
Formerly Liddell Electric Mfg. Co.
2-4 Randall Avenue
BRIDGEPORT, CONN.

2000 ohm Head Sets *$7.00*

3000 ohm Head Sets *$8.00*

Ford. A thousand thanks! God bless you."

The development of wireless has greatly enhanced the responsibilities of the ship surgeon. He stands no particular watch, but is ever on duty and ever at the service of ailing humanity, whether it be on his own vessel or those within "talking distance."

Dr. Michael Rebert, of the Steamship "Lone Star State," upon its recent arrival in New York, announced that he was going to sleep for two days consecutively as a result of the number of night calls to which he had been subjected through wireless applications for aid from passing freighters. Late one night the Doctor was aroused by the wireless operator who informed him that 12 members of the crew of a Norwegian freighter were in terrible agony and desired medical attention. Dr. Rebert inquired as to the history of the ailment and found that the crew had partaken quite freely of canned lobster. He diagnosed the trouble as being ptomaine poisoning, and when the 12 sufferers had finished with the Doctor's directions, they had exhausted their entire supply of Rochelle salts, and reported progress at dawn.

The work of the ship surgeons of the United States Lines has been so greatly enhanced that the company has decided to supplement them with graduate nurses. These nurses, all of whom are duly registered, have had long experience in hospitals and all of them were in the Government service during the war. With their aid it is expected that even greater service can be given passengers aboard the liners and to those who call for aid across the void.

Dr. Lee de Forest Predicts 20 Million Radio Listeners by 1927

(*Continued from page* 46)

ing those busy nights and days, the ether around New York was kept thoroughly agitated with music from 'Il Trovatore,' and more than one ship's operator working with his, then new, carborundum crystal detector had sudden doubts as to his sanity, or sobriety, when above the rattle of the 60-cycle spark he heard, distinct and clear, real music or human voices.

"There are indeed many names to be included in the honor roll recording the development of the modern Radio Telephone—not forgetting the still earlier period of Marconi, and today, if there is any one thought I should like to suggest to the new comers in the public field of Radio, through the Boston Radio Exposition, it is this: In our concern for the ever present let us not forget to pay due honor to those who in their laboratory research have made their contribution to this new field of activity and progress—Edison, Tesla, Stone, Fessenden, Carty, Squire, Alexanderson and many others yet to be publicly recognized.

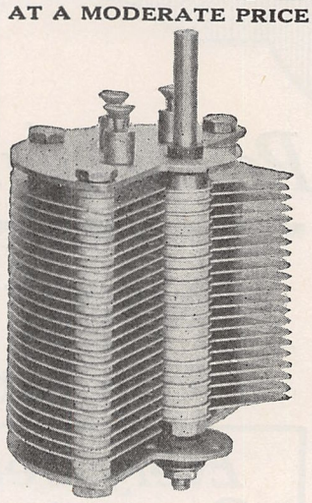
"At the same time, let us be duly grateful that Radio is beginning to come into its own. I say beginning, because I still feel that we are only at the start of the Wonderful Age of Radio.

"Today it is estimated that in the United States there are a million Radio listeners. Personally, I think the figure conservative. But I am positively certain that within two years, there will be five millions, and by 1927, twenty millions of radio receivers; with their antennæ, like twigs in the forest, draining the ether of its music, its spoken information and amusement, over the length and width of our land."

A THOUGHT OF THE DAY.

The only two publications we have run across lately that have no regular Radio Departments are the *Milliner's Journal* and the *Stamp Collector's Monthly!*

A HIGH GRADE VARIABLE
CONDENSER
AT A MODERATE PRICE



THREE SIZES
43 Plate.....$4.00
23 " 3.00
11 " 2.00

Designed by a reputable radio engineer, and built by a concern with 40 years' experience in the manufacture of electrical instruments.

MR. DEALER—Here is something that will interest you

Zimmerman Radio Co.
206 E. 12th Street NEW YORK

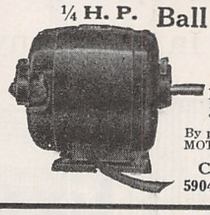
IMMEDIATE DELIVERIES TO CONSUMERS

Dreyfuss 'Phones
(*CONCERT TYPE*)
PRICE $8.00

Complete Crystal Receiving Sets
1 pair Dreyfuss 'phones
100 feet aerial wire
2 insulators 1 ground clamp
PRICE, $14.00

P. M. DREYFUSS
FOURTH FLOOR
150 CHAMBERS ST., N. Y. C.

¼ H. P. **Ball Bearing Motor**



with cord and plug and grooved or flat face pulley. (New)
110 Volt 60 cycle A.C.–$15.50
32 or 110 Volt D.C. – 16.90
By parcel post to your door C. O. D.
MOTORS GUARANTEED 1 YEAR
Convenience Mfg. Co.
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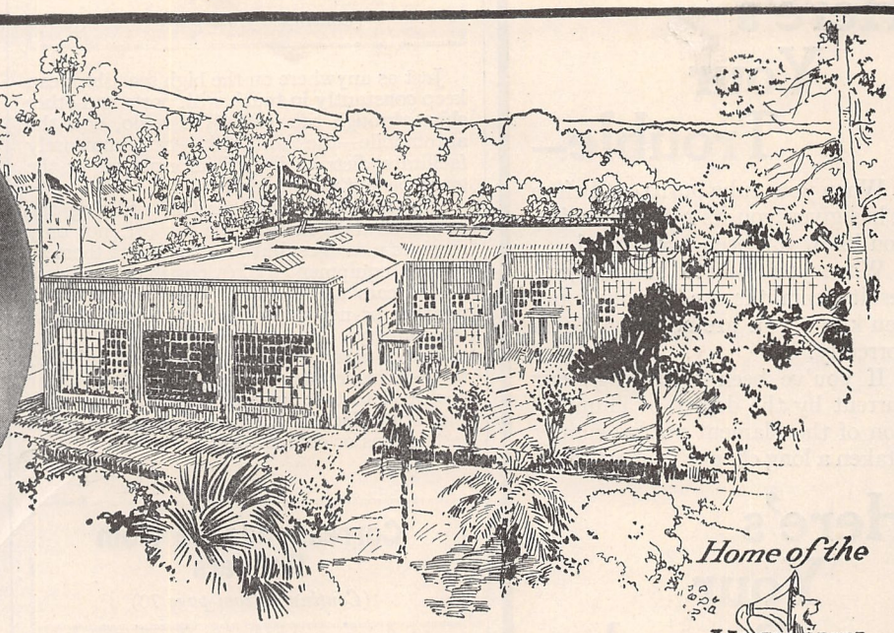
Quick Deliveries on
CONDENSERS
AND CONDENSER PARTS
We can give manufacturers and jobbers quick deliveries and low prices on Condensers of our design. Condensers or Parts in big quantities built to your specifications.
THE OAKES CO. Write us. Indianapolis, Ind.

Write for free catalog illustrating and describing our complete line of 1500 Good Tools.
GOODELL-PRATT COMPANY
Toolsmiths
Greenfield, Mass., U. S. A.



The Plant of the Magnavox Co., Oakland, California—one of the show factories of the Pacific Coast.

Home of the MAGNAVOX *products*

Essential to the full enjoyment of your wireless receiving set is the MAGNAVOX RADIO

A FEW months ago the Magnavox Radio occupied a relatively unimportant position in the list of Magnavox products—today even our greatly increased production facilities are taxed to supply the demand for Magnavox Radio, the reproducer supreme.

It is the Magnavox Radio which gives every receiving set its greatest enjoyment and use—doing away with the restrictions and limitations of the *individual headset*. The receiving set only *brings* the message, while Magnavox Radio *tells* it clearly and in full volume to all within reach of its voice.

Unlike the *telephone receiver* used on headset and some forms of "loud speaker"—which are constructed on the electro-magnetic principle—the Magnavox Radio exclusively develops the *electro-dynamic* principle and is thus a most efficient converter of electrical energy into sound waves.

The Magnavox Radio operates with any good type of receiving apparatus, and was not designed for any one particular make. Without the Magnavox Radio no receiving set is complete.

Any radio dealer will demonstrate; or write us for descriptive booklet and name of nearest dealer.

THE MAGNAVOX CO.

Home Office and Factory:
Oakland, California

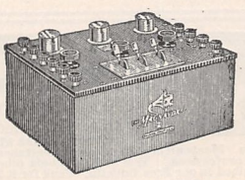
***New York Office:* 370 Seventh Ave.**

Type R-2 Magnavox Radio
with 18-inch Horn

THIS instrument serves the requirements of professional use for large audiences, dance halls, etc. **Price, $85.00**

Type R-3 Magnavox Radio
with 14-inch Horn

THE same in principle and construction throughout as Type R-2, and is ideal for use in homes, offices, amateur stations, etc. **Price, $45.00**



3-Stage

Magnavox Power Amplifier Model C

INSURES getting the largest possible power input for the Magnavox Radio. Can be used with any "B" battery voltage which the power tube may require for best amplification.

AC-2-C, 2-Stage..... $80.00
AC-3-C, 3-Stage..... 110.00

MAGNAVOX Radio

Here's Your Trouble—

When your tube burns out before it has given you its normal service, you know it's been overloaded.

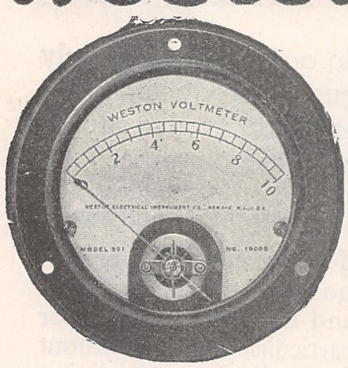
When you fail to secure good results from the use of your tubes you know you are not using them correctly.

If you've been regulating your current by the degree of illumination of the filament you've simply "taken a long chance"—***and lost!***

Here's Your Remedy—

Every make of tube should be operated at some specific voltage, as the manufacturer tells you. Don't *guess* at this voltage—its limits are extremely narrow. Install a

Weston



Model 301

Filament Voltmeter

and you can quickly establish and maintain exactly the proper voltage, prevent premature burnouts, increase the life of your tubes and secure satisfactory results.

One burned-out tube will almost pay the cost of a Weston Filament Voltmeter.

Is it reasonable to continue your high tube replacement expense and unsatisfactory service when so simple and certain a remedy is so easily available?

Our Circular "J" describes in detail Weston Filament Voltmeters and other important instruments invaluable to owners of up-to-date receiving and transmitting sets. Send for a copy without delay, if your dealer cannot supply you.

Weston Electrical Instrument Co.
173 Weston Ave., Newark, N. J.
Branches in the Large Cities

The Radio Car

(*Continued from page 46*)

Just as anywhere on the high seas ships can keep constantly in touch with ports and other ships through the use of the radio, now the automobile—the land ship—can immensely facilitate distribution of information to the great benefit of mankind.

One ingenious amateur, by utilizing the power of the generator on his car, not only receives messages, but also transmits them.

Such equipment makes possible the use of motor cars as scouts or reporters of crop, weather or news messages from any part of the country.

The news reporter need no longer be obliged to beat his rivals to the wire. With a car equipped to talk instantly and directly with the radio office of his paper, he is free of all restrictions or competition.

Correspondence from Readers

(*Continued from page 70*)

and WJZ in a medium sized room with a home-made loud speaker, and transmit WGY 10 miles over the telephone. Still I am sometimes unable to hear some of them sign, but could if they would repeat or sign more often.

G. W. PERKINS.

Thomson, N. Y.

A Lady (Radio) Bug

(*Continued from page 53*)

The main electrical switch is thrown in action, which energizes the control switches with current. Number two switch gives momentum to the motor, while the unit labeled as number three is for field of generators. Switches numbered four and five are reserved for bulb filaments. The series of switches are thrown in consecutively. Once they are in operating position, the rheostat handles are moved to the right —clockwise—until the voltmeter on the 50-watt power tube reflects 10 volts and the voltmeter on the 5-watt unit reads 5.5 volts.

The voltage through the primary of the telephone transformer is varied by the voice impressions on the microphone diaphragm. The transformer steps the voltage up and varies the grid current. This, in turn operates the plate current, and as the plate circuit or output of the modulating tube is connected across the plate circuit of the oscillating tube, the continuous oscillations are varied or modulated. The inductance is a radio-frequency choke of 2.2 millihenries, to forestall the flow of oscillations back into the plate of the modulating tube, thus causing loss of current. The filaments of the bulbs are energized from the 110-volt direct-current source of supply. The two filaments are linked in series and burn on the drop of the potential across the resistance.

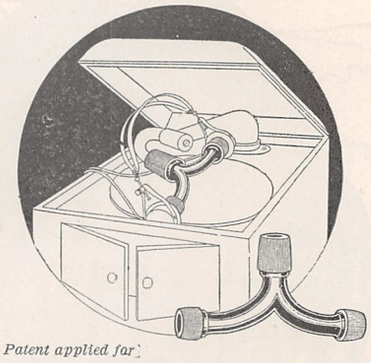
Miss Loomis, other than acting in the role of inventor of radio instruments and as a teacher on the subjects of radio engineering, has written a text-book on radio telephony. The contents are concerned with the historical significance of the subject and its present-day ever-expanding applications. The book will come from the press about the middle of May. The subject of this sketch is in possession of a first-grade radio license granted her during the World War by the United States Department of Commerce. She claims that a cousin, Dr. Mahlon Loomis, demonstrated the use of wire-

PHONOTACH

Makes Your Phonograph a Radio Loud Speaker

(Trade Mark)

Adjust it in a minute.



Patent applied for

A New and Better Loud Speaker
at a very low cost

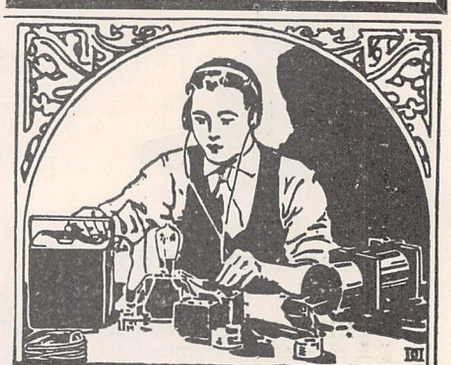
The PHONOTACH connects the receivers with the tone arm of your phonograph.

Utilizes the scientifically designed tone amplifier of the talking machine to secure mellowness and beauty of tone.

Price - $3.00

Send for one today—At your dealer, or by mail.

W. A. MILLS,
103 Park Ave., New York, N. Y.



The HOME RADIO

How to Make and Use It

By A. HYATT VERRILL

At last! A simple explanation of the making and use of a home radio outfit. Every step in construction is carefully directed and illustrated with numerous working diagrams. Get your copy today. A cloth bound book.

Postpaid for 75c.

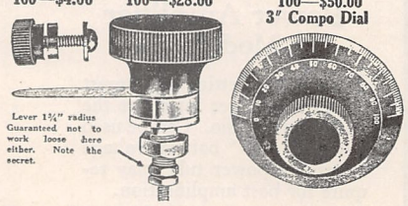
RADIO EDUCATIONAL SERVICE
200 R—5th Ave.—R 416—N. Y. C.

High School Course in 2 Years

You can complete this simplified High School Course at home inside of two years. Meets all requirements for entrance to college and the leading professions. This and thirty-six other practical courses are described in our Free Bulletin. Send for it TODAY.

AMERICAN SCHOOL
Dept. HB-85, Drexel Ave. & 58th St. CHICAGO

5c ea. 100—$4.00 | 40c ea. 100—$28.00 | 70c ea. 100—$50.00 3" Compo Dial



Lever 1¾" radius Guaranteed not to work loose here either. Note the secret.

No. 7138 $1.30 per 100

No. 6647 $1.20 per 100

All styles of Binding Posts and Radio Parts manufactured and carried in stock. Get illustrated folder.

Continental Electric Co., 117-119 E. 129th Street New York, N. Y.

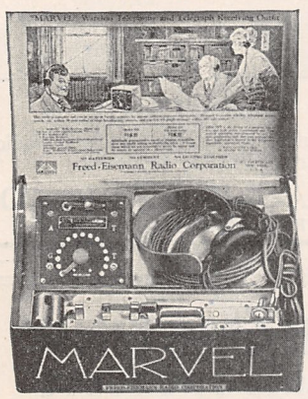
Immediate Delivery on This Dependable, Guaranteed "Freed-Eisemann" RADIO APPARATUS

THE UTMOST IN RADIO

that $15 will buy

MARVEL REG. U. S. PAT. OFF.

Radio Receiving Outfit



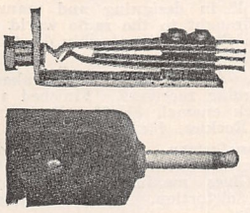
A COMPLETE Crystal Radio Telephone Receiving Outfit, with a range of 25 miles for telephone and hundreds of miles for telegraph. Wave length range from 180 to 2600 meters. This is the famous set you have seen in the newspapers, magazines, and movies. Comes complete with antenna equipment, antenna wires, insulated wires, insulators, switches, ground clamp, phone headset. Nothing additional required.

MODEL 105—With single 1000 Ohm Telephone headset..... **$15**

MODEL 110—With double 2000 Ohm Telephone headset..... **18**

Model 110 is the most popular outfit—at least 2 people can "listen in" at once.

"Freed-Eisemann" Radio Jacks and Plugs



"F-E" Jacks and Plugs are standard in all high grade receivers, amplifiers, etc. Can be used without adjustment on panels from 1/8" to 3/8" thick. Contacts are solid silver. Plugs take cords with pin, spade or wire tips.

MODEL 116—Single Contact Jack. Each..... **$0.55**

MODEL 117—Two-Contact Jack. Each..... **.75**

MODEL 118—Two-Circuit Jack. Each.... **$0.90**

MODEL 103—Universal Radio Plug. Each.. **1.25**

"Freed-Eisemann" Galena Crystals

GUARANTEED most sensitive obtainable anywhere. Each crystal undergoes three separate tests before shipment. Cast in special metal mold, untouched by anyone's hands. Look for the "F-E" trade mark.

MODEL 108—"F-E" Triple Tested Mounted Galena Radio Crystals. Each..... **25c**

"F-E" Vacuum Tube Sockets

Consist of a heavy polished aluminum tube, the inside of which is accurately formed to the proper diameter for standard vacuum tubes. The socket is rigidly secured to the insulating base, for nickel silver contact-blades are mounted diagonally under the four terminals at the corners. The terminal posts have extended hexagonal studs which can be used as connection studs for panel mounting. This socket is a very substantial, lightweight and efficient device.

MODEL 146—"F-E" Single Socket, 2½" x 2¼" x 1½". Each..... **$0.75**

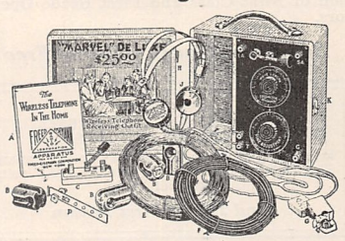
MODEL 149—"F-E" Double Socket, 2¼" x 4½" x 1½". Each..... **1.50**

MODEL 150—"F-E" Triple Socket, 6¾" x 2¼" x 1½". Each..... **2.25**

that $25 will buy

MARVEL REG. U. S. PAT. OFF.

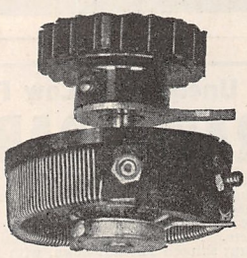
De Luxe Radio Receiving Outfit



THE FINEST Crystal Radio Telephone Receiving Outfit obtainable—the Marvel De Luxe is the result of careful design and latest development. The outfit is complete in every detail, the receiver being equipped with "step by step" tuning as well as continuous fine adjustment. Radio news and music have been heard within 35 miles of a large broadcasting station. The wave length range is 180 to 3000 meters. Comes complete with antenna wires, insulating wires, insulators, switches, ground clamp, etc., and double telephone headset, leather covered headband, with double xx 3000 Ohm phones. Nothing additional required.

MODEL 111—Marvel De Luxe Radio Outfit..... **$25**

Filament Rheostats



THESE Rheostats are designed for use in filament circuits of vacuum tubes. For front or back of panel mounting. Resistance is 6 Ohms.

MODEL 139—Filament Rheostat. Each..... **$1.25**

"Freed-Eisemann" Fixed Receiving Condensers

Patents Applied For

These condensers consist of alternate layers of pure tinfoil and special dielectric material. Connection is made to the tinfoil plates by means of copper tabs which are securely fastened to the main insulated base. The grid condenser is the correct size for connection in series with the grid of receiving vacuum tubes. The telephone condenser may be used to shunt around the telephones on a crystal detector circuit, or to be put across the telephone or input of vacuum tube amplifier, transformers, etc.

MODEL 106—"F-E" Grid Condenser, capacity 0.0005 mfd. Each..... **30c**

MODEL 107—"F-E" Telephone Condenser, capacity 0.0025 mfd., Each..... **30c**

INSIST ON *"FREED-EISEMANN"* RADIO APPARATUS—EVERY SET AND SEPARATE PART UNCONDITIONALLY GUARANTEED —IF YOUR DEALER CANNOT SUPPLY YOU WRITE DIRECT

FREED-EISEMANN RADIO CORPORATION

FREED-EISEMANN RADIO CORPORATION APPARATUS REG. U. S. PAT. OFF.

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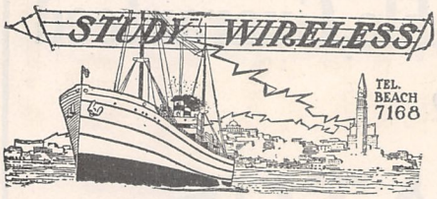

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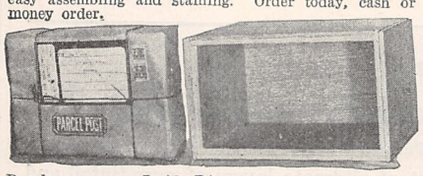

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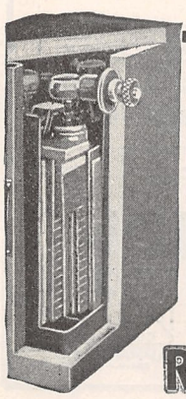

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RADIO-RUBR STORAGE BATTERY

less telegraphy some years before Marconi was born. Be that mooted question as it may, Miss Loomis has demonstrated unusual talent as inventor, teacher, and as a principal of a radio engineering school. Strange to say, her early predilection determined her life pursuit in the fields of music and languages. She can speak French, Italian, and German. Moreover, in the parlance of the street, she knows still another "language"—that of the technician, for she is quite as well versed on the fine points and technic of radio telephony and radio telegraphy as on the simpler things of life. In other words, she has mastered her profession.

Protection Against Danger From Atmospheric Electricity

(*Continued from page* 33)

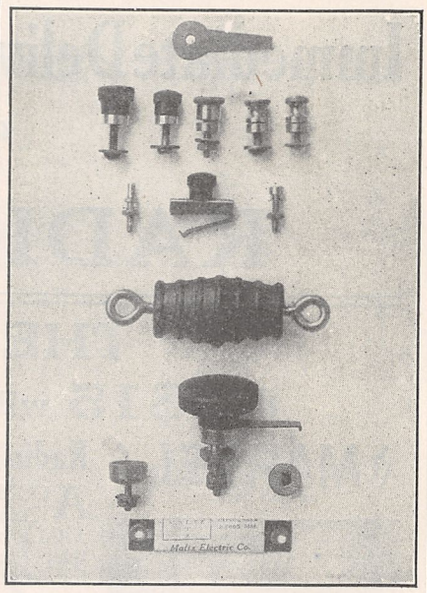
static. When warm weather comes atmospheric electricity is generated in much larger quantities. The intense heat of the summer sun evaporates the moisture on the surface of the earth and water from ponds and lakes very rapidly. This evaporated moisture or vapor, becoming heated, rises to the upper atmosphere and upon reaching the higher levels where the temperature is lower, the water vapor condenses into minute drops of moisture and forms clouds. Each moisture particle becomes charged with a very small amount of electricity. As the moisture particles in the upper air become more dense the particles crowd together and one particle combines with another. This combination increases the electrical charge on each particle until finally a thunder cloud is formed which is very highly charged with electricity.

It is a known fact that when thunder storms are in formation electric discharges occur within the cloud. These discharges are popularly known as sheet lightning. Every time such a discharge takes place, radio waves are emanated and these waves impinge upon your antenna, causing a sharp crash or crackle in the telephone receivers if you happen to be listening in.

A thunder cloud must be regarded as a huge bubble containing electricity. Discharges are constantly taking place within the bubble and increasing in size. When a certain critical point is reached, the bubble bursts, the pent up electricity discharges in one swoop to the earth, and we hear a mighty thunder clap. If this lightning bolt strikes within one-half mile of your antenna, considerable current will be induced in your aerial system. This induced current will pass harmlessly to the ground and you will be unconscious of its presence if you have taken the proper precautions.

Let us consider the great bubble once more. If we prick tiny holes in this bubble while it is in process of formation, the pent up electricity will gradually discharge. If we prick enough holes in the bubble, the electric charge may leak away so fast that the quantity of electricity within may never reach the point where the bubble will burst. The function of the common lightning rod and the properly grounded or protected antenna is to prick holes in the great electric bubble in the sky, and convey its charge silently to the ground. For this purpose the average radio antenna is exactly as effective as the lightning rod.

"What will happen if a lightning bolt actually strikes my antenna?" is a familiar question. Let us consider the nature of a lightning bolt. The heavy thunder clap which attends its appearance gives the impression of tremendous energy. It is true that lightning is destructive, but as a matter of fact its bark deceives one of its might. The average lightning bolt contains about as much energy as is represented in a pint of gasoline. The only difference is that the energy of lightning



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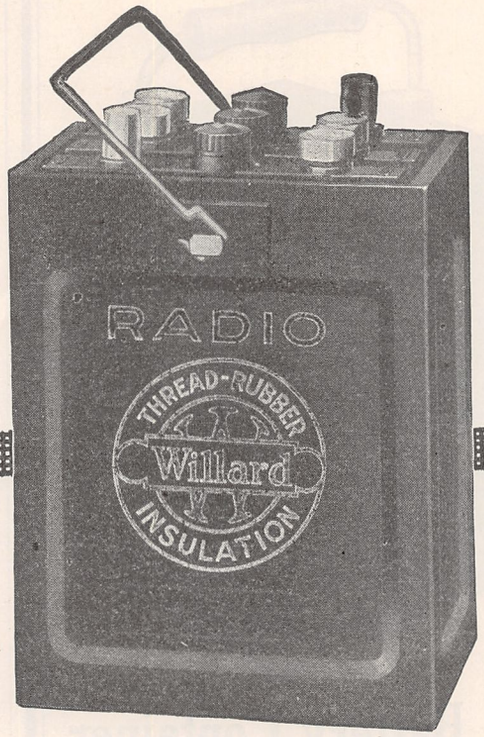
Stop that Leakage!

The Willard All-Rubber Radio "A" Battery (shown at the right) is not an automobile battery adapted for Radio use, but is a special radio battery built for the reception of C W and spark messages. The reduction of the weight of connectors, the increase in thickness of plates, the special radio type of Threaded Rubber Insulation are all features that are necessary to an efficient, economical battery of this type.



You'll have to admit it's annoying to have a radio concert or a conversation interrupted by noises that sound as if all the animals in the zoo had cut loose at once.

Some of these noises can't be stopped by even the most careful tuning. They can be ended only by removing the leaky cell or the leaky battery that's responsible for them.

One of the most important features of the Willard All-Rubber Radio Battery is that it is absolutely leak-proof. Battery case and jars are cast in one solid piece of rubber, eliminating the possibility of leakage either from cell to cell, or to ground. Every case is tested at 24,000 volts.

The Willard All-Rubber Radio Battery has the same Threaded Rubber Insulation as the Willard Threaded Rubber Automobile Battery. The Willard Radio "B" Battery is a 24-volt rechargeable storage battery, with leak-proof glass jars and Threaded Rubber Insulation. Assures freedom from frying and hissing ground noises. Ask for particulars from your dealer, or at the nearest Willard Battery Station.

WILLARD STORAGE BATTERY COMPANY, Cleveland, O.

Made in Canada by the Willard Storage Battery Co. of Canada, Limited, Toronto, Ontario

Willard THREADED RUBBER BATTERY

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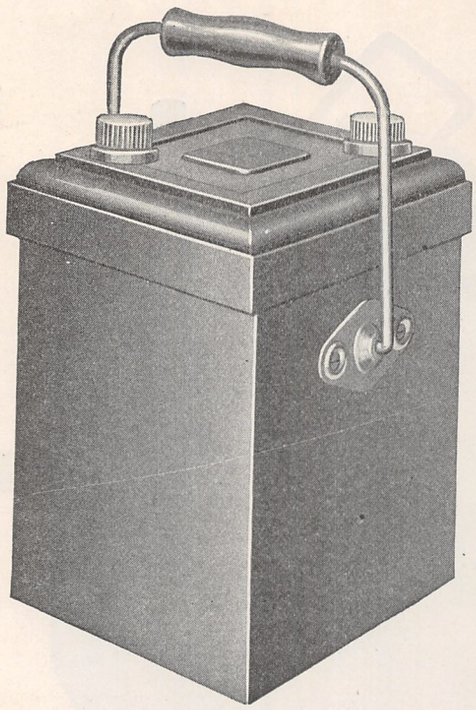
One-Piece—With Rub-Tex Lid and Grip

Non-Breakable, Complete Protection Against Damage by Acid

Rub-Tex One-Piece Battery Containers are guaranteed not to break or leak in radio service. They are NOT hard rubber—there can be no leaks or pin holes. They have a beautiful, lasting finish and a striking design. The cover conceals the top of the battery. For better value and trouble free operation—demand batteries built with the RUB-TEX One-Piece Container. More service for your money.



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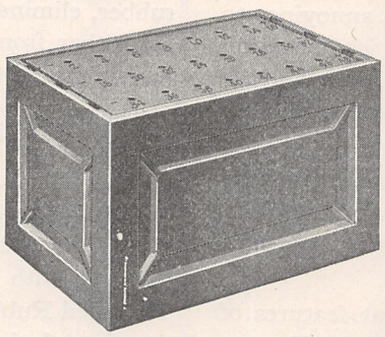

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is exerted instantaneously. Take, for instance, a cupful of gasoline and ignite it under a saucepan containing a tallow candle. The heat of the burning gasoline will melt the candle. The phenomenon is silent and harmless. Take another cupful of gasoline and dump it into the gas tank of the family flivver, crank up, and drive thirty miles an hour, head-on into a concrete wall. The effect is startling. Even Henry himself could not put together the remains and make them rattle once more, yet the energy involved was no more than that necessary to melt the tallow candle. The essential difference lies in the fact that in the first case the energy was released gradually and in the second case the energy was released instantaneously. A bolt of lightning represents an electrical collision. This accounts for its many strange antics, such as stripping the soles from shoes of persons struck, smashing crockery, or ripping off the wall paper.

The average lightning bolt never plays according to Hoyle, and if it does ever strike your antenna it will probably not follow the direct low resistance path to ground which you have carefully provided, but instead may jump to the chicken coop, causing the feathers to fly, or wreck the gas stove or refrigerator. The lightning, if it ever strikes, will be blissfully oblivious to the fact that you ever had a radio set or antenna or ever thought of having one. You may have a fine nickel-plated bumper on the front of your automobile, but if you collided with a locomotive going 60 miles an hour, it would be difficult to find the remains of the car let alone the nickel-plated bumper.

So far as your radio installation is concerned, you should harbor no fear that it will attract lightning. The chances of lightning striking your home this summer are no greater than the chances last summer. You should make it a point, however, to install such safety devices as will render harmless the currents induced in your antenna by lightning bolts striking in the neighborhood.

We will consider separately the precautions necessary to protect your home, yourself and your radio set against any slight derangement from atmospheric electricity. With your home in mind, take the following procedure:

First, install a lightning switch or a grounded short gap of approved design. Avoid the purchase of slate base switches, gaps, or any other devices which do not support the ground conductor at least five inches out from the wall or building.

Second, install a ground conductor running as directly as possible to a good ground connection. A ground connection may be a water pipe, several galvanized pipes driven in the soil and connected together, or metal plates buried two or three feet below the surface of the earth. The water-pipe connection is generally regarded as satisfactory and sufficient. The ground conductor running from the lightning switch or grounded short gap to the earth connection must be of sufficient size to conform with the regulations, which specify that the periphery of such a conductor be at least three-quarters of an inch. To comply exactly with the specifications you should use a No. 2 copper wire, copper tubing one-quarter inch outside diameter, or copper ribbon three-eighths of an inch wide. Of the three, copper ribbon is the least expensive. The ground conductor must clear the wall of the building at all points by at least five inches and should be mounted on insulators which provide this amount of clearance. All connections should be soldered.

Third, have the installation approved by your local inspector so that in case any damage to the building by lightning ever comes to pass, the validity of the radio installation will not be questioned.

Many people are at a loss to decide between a lightning switch and a grounded short gap. Both of these devices, properly constructed, are approved by the National Electric Code. Let us compare the merits and demerits of both.

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is proving its superiority by the reports of its efficiency

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Crosley Harko Senior V
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A SIMPLE non-regenerative receiving set—easy to tune and use. The Crosley make-up eliminates objectionable radio telephone carrier waves. Owners throughout the country are enthusiastic over the results it obtains. The low price is due to both quantity production and its obvious simplicity. Does all that expensive sets do, and for those with no technical knowledge and whose interest in radio is only for the entertainment that can be gotten out of the air, it is unequalled.

Each instrument guaranteed perfect on "money-back" basis. Nothing needed but head phones, tubes and batteries to enjoy broadcasted radio concerts.

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Two-Step Amplifier similar in size and design to this receiver is

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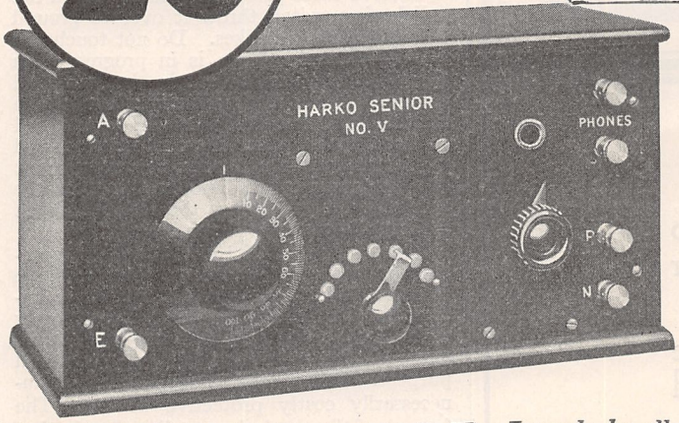

Radio Crosley Receiving Sets

Harko Senior V is pictured.
Harko No. X—Tuner, detector and amplifier in one cabinet.
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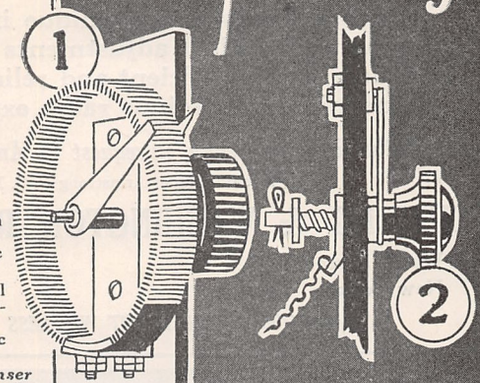

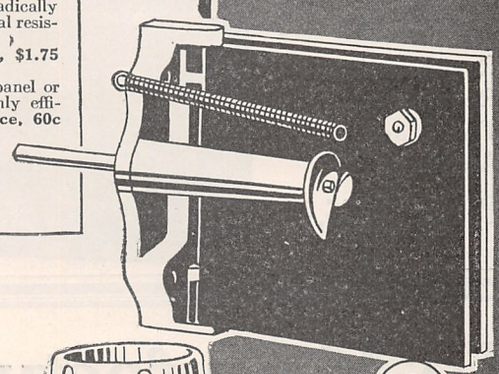

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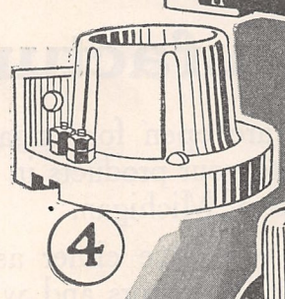

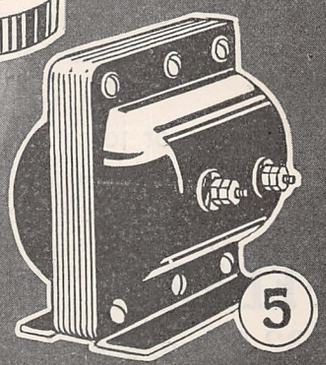

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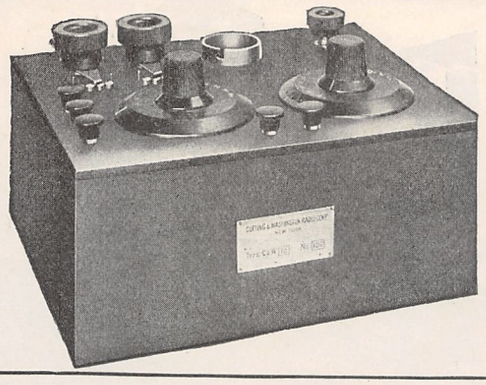

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Extraordinary efficiency and selectivity is obtained with simplified controls that enable the operator to select the desired signals and to easily eliminate interference from other sources.

These Receivers are unique in that many troublesome and critical adjustments have been eliminated thus assuring efficient and reliable operation by persons with no previous radio experience.

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The lightning switch costs more to buy. It must be operated manually to provide the proper protection, but when thrown to the grounded position it provides a more positive protection than the grounded short gap. With the lightning switch in a closed position, a heavy electric surge induced in the antenna by a bolt of lightning striking near by will pass swiftly to ground and damage to your property will be a very remote possibility indeed.

The grounded short gap costs less to buy and its operation is automatic. It does not, however, discourage a discharge from entering the building, as the wire leading to the receiving set is permanently connected directly to the antenna. When a grounded short gap is employed, high potentials are often built up within a receiving set when a thunder storm is in progress and the insulation within the set is subjected to heavy strains. On the other hand, if one must operate his set when a thunder storm is in progress, it is safer to operate it when connected to a grounded short gap than when connected to a lightning switch.

We will now consider the protection of the radio set itself against possible damage from heavy electrical discharges. The best precaution to follow is to disconnect antenna and ground lead wires from the terminals of the set before the thunder storm breaks. If you do not care to disconnect the set, a protected gap should be purchased and connected across the antenna and ground terminals on the instrument. A substitute for such a gap can be provided in the form of a burnt out flashlight bulb screwed into a miniature base, the terminals on the base being permanently connected to the antenna and ground terminals on the receiving set. If the latter terminals are mounted close together a discharge gap may be provided by clamping two ordinary sewing needles in the terminals, separating the points by the thickness of a piece of paper. For maximum protection, however, complete disconnection of the receiving set from antenna and ground connections is advised.

As for self-protection, we again emphasize the remote possibility of a personal encounter with lightning due to the existence of radio equipment in your home. For safety's sake, however, respect these few "don'ts," and you need never suffer discomfiture:

Don't attempt to operate the set while a local thunder storm is in progress. You can hear nothing but static discharges anyway, the elimination of which is entirely beyond your control.

Don't touch the ground wire or the antenna lead wire while the storm is in progress.

Observe these precautions also: If you use a lightning switch throw it over to ground before the storm strikes. Do not touch the switch while the storm is in progress even though it may not be set in the grounded position. Keep the window next to the lightning switch or grounded short gap closed until storm is over. If your antenna lead wire is brought in under the window without any insulating tube, disconnect it from the receiving set and throw the free end out of the window until the storm is over.

There is much criticism of the present regulations respecting protective devices for the radio antenna. In many instances it is impossible or at least impracticable to comply with all the specifications in the regulations. Some of the requirements serve no useful purpose. Others require the purchase of unnecessarily costly protective devices. The framers of the regulations realize already that some revision must be made. Meantime you should make every effort to comply with the spirit of the regulations as they are framed in your personal interest and in the interests of the community.

The chances of you, your set, or your property ever being injured by lightning are very remote. This summer lightning will play its pranks just as if radio sets in 500,000 Ameri-

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Extra thick, especially treated separators which prevent internal discharge.

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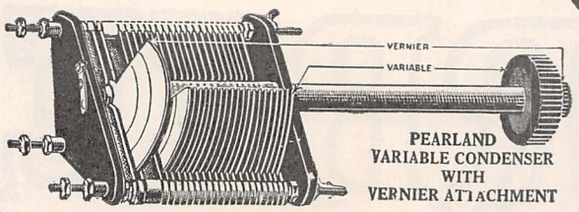

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WITH
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Patent Applied For

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Both of these instruments are combined in **one**, simplifying your set and making it easy to get your connection clear, loud and quickly. The Vernier attachment allows an adjustment about 20 times as fine as the plain condensers, with much greater ease and accuracy. The back panel mounting is made with non-conducting operating shafts. This makes shielding unnecessary and reduces fixed capacities or grounds to a minimum. The Pearland Variable condenser with Vernier Attachment and the Pearland Plain Vernier Condenser are both made of the finest materials that money can buy, and the most skilled workmanship that money can command.

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No. 22 V. Variable Condenser with Vernier Attachment, 22 plate capacity; approximately .0005 Micro Farads. List price.. $8.00

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No. 43. Plain Variable Condenser, 43 plate capacity; approximately .001 Micro Farads. List price $8.50

Pearland Variable Condensers can be cut to fit any radio set.

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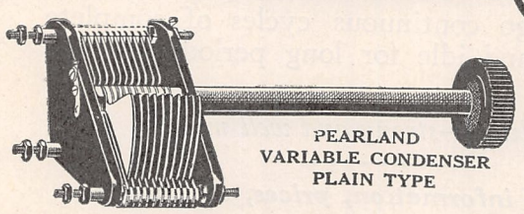
THE PEARLAND RADIO & ELECTRIC CORP., INC.

Dept. A: Offices, 184 W. Washington St., Chicago, Illinois

Phone Dearborn 3298

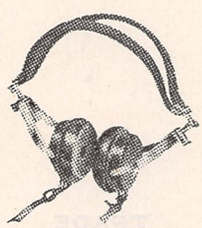


PEARLAND
VARIABLE CONDENSER
PLAIN TYPE

Patent Applied For

D. H. E. Co. Pittsburgh Broadcasting Station, K.Q.V.

"Listen In" with the Stromberg-Carlson Radio Headset



Stromberg-Carlson
No. 2A Headset

$7.50

The Stromberg-Carlson No. 2-A Headset reproduces broadcasted, long-distance vocal or musical sounds with unequalled distinctness. Fine tonal qualities, extreme sensitiveness and superior construction are its important features.

Order Above and Following Highest Grade Supplies by Mail

Enclose Certified Check or P. O. Money Order, Including Postage

R-C Westinghouse Receiver	$130.00
Aerola Senior Westinghouse Receiver	65.00
CR 9 Grebe Receiver	130.00
CR 5 Grebe Receiver	80.00
RORK Grebe 2-stage Amplifier	55.00
R2 Magnavox Loud Speaker	110.00
R3 Magnavox Loud Speaker	45.00
UV 200 Radiotron Detector Tubes, each	5.00
UV 201 Radiotron Detector Tubes, each	6.50
No. 766 Eveready VT Batteries, each	3.00
Gould 6 Volt, 60-80 Ampere Storage Batteries	23.00

Full List of Parts and Supplies with Prices on Request

DOUBLEDAY-HILL ELECTRIC CO.

715 Twelfth St., N. W., Washington, D. C. *Radio Dept.—Desk B* **719-21 Liberty Ave., Pittsburgh, Pa.**

can homes were undreamed of. If, however, lightning should cause damage where radio is installed, the incident will call for a scare head in the newspapers, simply because radio at this time is so sharply focused in the public eye. Do not, through neglect, become involved in sensational reports which only encourage the false belief that radio antennæ attract lightning.

The telephone company installs its instrument in your home with simple, inexpensive, approved protective devices. But you are warned not to use the telephone during a thunder storm. Regard the use and installation of your radio in exactly the same way and you will be as safe as a cricket in the Mammoth Cave.

*(*See article on the new Underwriters' Regulations on page 31 in this issue.*—EDITOR.)

Now the Farm Radio Club

(*Continued from page* 53)

members and serves the farmers in 11 different communities with market and other news received by radio. This is the principal object of the club. From time to time the farmers are also invited to attend the radio concerts. The club has become extremely popular. In disseminating market reports, news items, weather forecasts, lectures and music the members of the club feel that they are making a material contribution to the prosperity and happiness of the community.

Each member has a receiving set and as soon as the market and other news is received it is sent to the farmers by telephone, posted on local bulletin boards, and the like. The club also has three C. W. transmission sets for relay work. One of these is 2AAB operated by Richard Huggard of Lakewood, New Jersey. This transmitter is a 5-watt tube C. W. set operating on alternating current at 350 volts, and 500 miles is consistently covered. Messages sent with this set have been heard in daylight in Houma, Louisiana, a distance of about 1,200 miles. It has also been reported by ship operators at Haiti and by a ship 1,650 miles N. E. of New York City. To work through the heavy interference caused by the congested amateur wave, Huggard recently installed a 50-watt set.

Another set is that of Bartlett Havens of Toms River, New Jersey. This is a 5-watt C. W. transmitter. Using one tube, Havens gets 1.7 amperes radiation, and can use straight C. W. or buzzer modulated C. W. For receiving messages he uses a regenerative receiver and detector and two-step amplifier. Using a Tresco tuner he gets all the long-wave C. W. stations in both America and Europe.

Three members of the club were recently appointed by the Agricultural Extension Service a committee to demonstrate the use of radio at the Eastern State Exhibition at Springfield, Mass. Demonstrations have also been given at Trenton, N. J., and Toms River. At Toms River, with the use of a four-step amplifier and Magnavox, signals and music were literally heard all over town, and amateurs in Canada were heard half a mile from the receiving set.

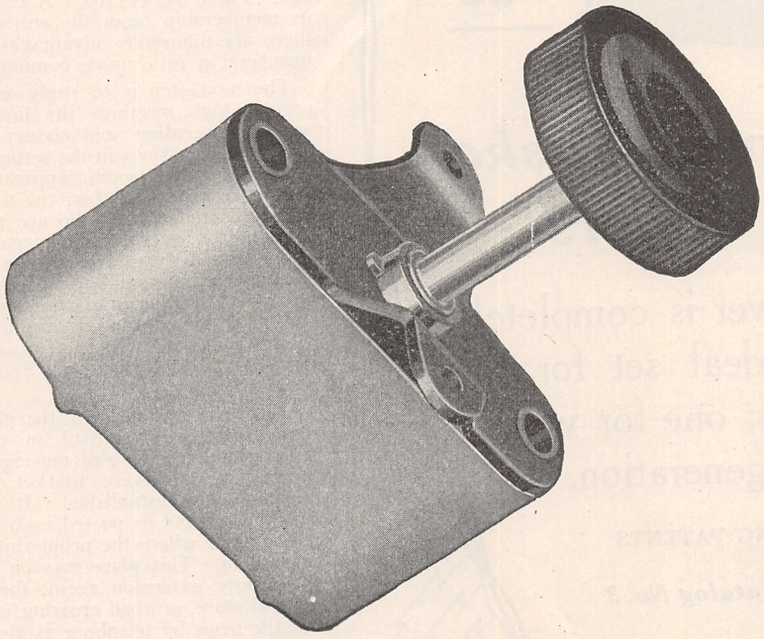
"The farmers of every community," officials of the Department of Agriculture state, "have long been in need of accurate and current information on weather forecasts, crop conditions, and market quotations to guide them in their daily farm operations. Information on these matters, which comes through the mails, often loses much of its value because of the time consumed in reaching the reader. Radio communication reduces the time consumed to a minimum. It has developed to such an extent that it has become a practical convenience for the farm, but before it will be widely used its practicability will have to be demonstrated.

"This opens a splendid opportunity to the county extension agents. To conduct radio

Bradleystat

REGISTERED U. S. PAT. OFF.

PERFECT FILAMENT CONTROL



Price - $1.85

AT ALL RADIO DEALERS

Add 10c postage when ordered from

Allen-Bradley Co.

Electric Controlling Apparatus

287 Greenfield Ave., Milwaukee, Wis.

Why is Accurate Control so Essential?

When a freight elevator is stopped at a certain floor to unload heavy freight, you have seen how carefully the operator tries to bring the elevator level with the building floor. If the car is an inch too high, jar and damage result when the heavy load drops from the elevator to the building floor. If the car is an inch too low, it is often impossible to get the load out of the car. There is but one place to stop, and that is exactly at the build ing floor.

And so it is with detector and amplifier tubes. The filament current is like the elevator, and the radio waves are the freight. If the current through the filament is exactly right, the waves enter without fuss. If the current is wrong, only a few can enter.

The control of filament current must be accurate beyond all ordinary ideas of accuracy. It must be precise, if you want full benefit from radio waves intercepted.

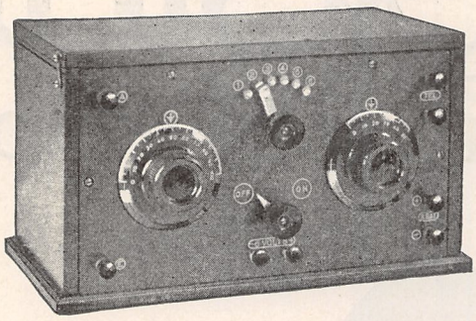
The Bradleystat provides just such control with one adjusting screw, and without verniers or other complex attachments. Its control is as smooth, stepless and noiseless as a gas valve. It results from the application of a well-known principle of electric current control by an established, nation-wide organization. There are twenty years of direct experience behind the Bradleystat.

The Bradleystat is for all ½ and 1 ampere receiving tubes and sending tubes up to 2½ amperes. Avoid wire wound rheostats for filament control. Insist on the Bradleystat.

TUSKA

Popular Radio Receiver

Type 224



Price $35

Inspect this new Tuska Set at your dealers

The Type 224 Receiver is completely moulded. It is the ideal set for the beginner. Two knobs; one for wave length, the other for regeneration.

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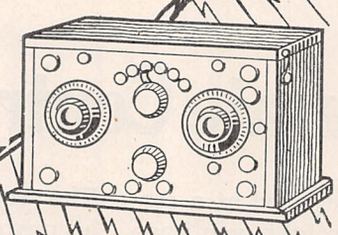
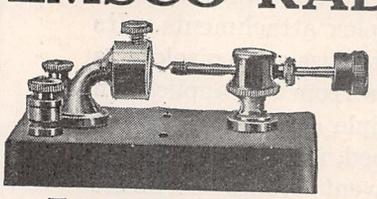
Send 5 Cents for our New Catalog No. 3

The C. D. Tuska Company
24 Hoadley Place
Hartford, Conn.



EMSCO RADIO PRODUCTS—

Made by Experienced Electrical Manufacturers



Turret-Top Detector

Decidedly the best detector so far produced. Sturdy and well made of the best materials. "Turret-Top" swivel adjustment permits the greatest range of adjustment and holds the phosphor-bronze "cat whisker" contactor steadily in any position. Thumb lock assures permanent adjustments. Locking-notch feature of binding posts exclusive with this detector. Unbreakable base. A fair example of EMSCO quality and value.

You take no chances when you buy EMSCO products. Behind each article is the skill of many years' experience making wireless and electrical equipment. That is why the trademark, EMSCO, always signifies outstanding merit. Reliable dealers handle EMSCO products. If your dealer hasn't them write us.

Just a Few EMSCO Products

Binding Posts
Single and Double

Wound Rotors
3"—3½"

Single Slider Tuners
6"—8"

Double Slider Tuners
6"—8"

Weatherproof
Strain Insulators
Vario Couplers

Square Rods
Cut and Drilled
3/16x7 ¼x7
3/16x8 ¼x8
3/16x10 ¼x10
3/16x12 ¼x12
3/16x7 Extension Threaded

Enamel Wound Coils
6"x3" 8"x3" 8"x3½"

Sliders
3/16 and ¼

ELECTRIC MFG. & SALES CO., 90 Academy Street Newark, N. J.

demonstrations through boys and girls is to grasp this opportunity and contribute to the solution of a problem that is universal. Such clubs receive and disseminate daily information. Each member sets up and uses a receiving outfit, thus demonstrating its usefulness. The outside world in this way is brought to the farm home doorstep. By disseminating the information received to other farms by telephone or through notices, the radio club member serves his community and adds to the desirability of farm life."

In instructing county agents in methods of organizing farm radio clubs it is suggested that local leadership be placed preferably in the hands of boys who are already familiar with the rudiments of wireless operation.

The other members of the club need have no knowledge of radio but should be not less than twelve years of age and should be in a position to secure the necessary radio equipment. A president, secretary and manager should be elected. A club may draw its membership from the entire county, but there are numerous advantages in confining membership to a single community.

The next step is to study and discuss at regular club meetings the laws regulating wireless operation, and codes; also to witness demonstrations in the setting up and use of receiving and sending apparatus. A number of text books for the beginner and advanced student in radio are recommended for study. Several radio magazines including RADIO NEWS, are also suggested for contemporaneous reading. Methods of sending and receiving messages are explained, and it is stated that descriptions of types of instruments will be furnished by the United States Bureau of Standards upon request.

When the members of the club have become sufficiently skillful in the accurate sending and receiving of messages, a regular service for receiving market reports and other news is established. It is suggested that the reports be posted each day in some public place where the people interested may read them. This place may be the office of the county extension agent, the post office, general store, or road crossing. Disseminating the news by telephone is also suggested.

According to the instructions, each member should make a duplicate of each wireless report received and at the end of the week forward the duplicates through the local leader to the county agricultural agent. Provision is also made for keeping a record of each report received on weather, crops and markets, so that the records may be studied and compared at club meetings.

The Department of Agriculture is endeavoring to establish the radio market news service on an efficient basis. It recognizes that there are many obstacles in the way of making it an immediate complete success, but so far as these have been considered up to the present time, it is felt that they are not insurmountable, and it is thought that with the coöperation of State and local agencies and suggestions from radio operators located throughout the country who are receiving the reports, the Department may be able soon to put the service on an entirely practical and substantial basis.

The farm radio club idea has tremendous possibilities. It is expected that within the next two years hundreds of these clubs will come into existence. Federated into a national association the farm boys and girls will have a radio organization second to none in the country in size and usefulness.

'TWAS SHORT CIRCUITED

MR. SMITH: "I just bought this battery and I can't get any current out of it."

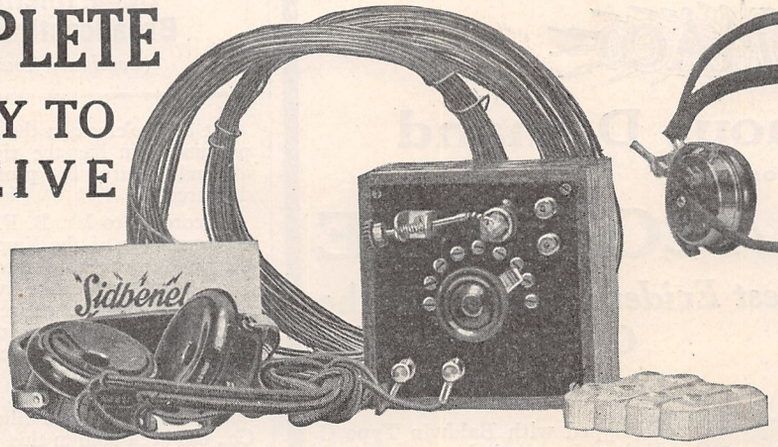
MR. JONES: "Did you have it charged?"

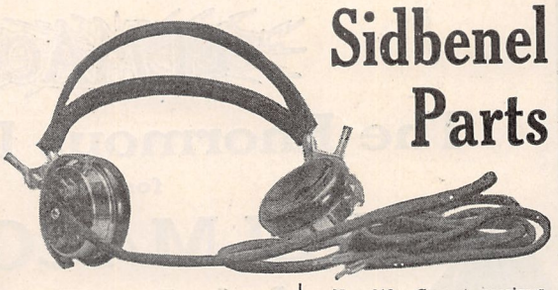
MR. SMITH: "No—I paid cash for it."

—E. M. F.

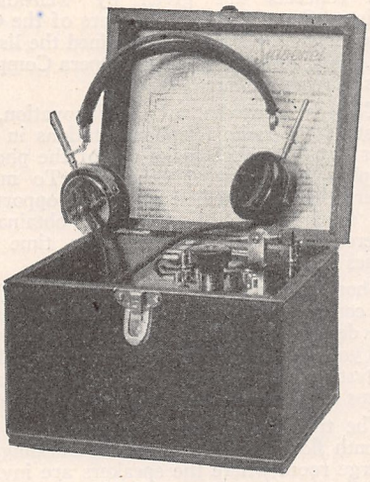
COMPLETE READY TO RECEIVE

$10.00





Sidbenel Parts



This set will bring in Farm Reports, Voice and Concerts exceptionally loud and clear. Tunes from 150 to 1,800 meters. Can be accurately adjusted to tune out interference. Hundreds of letters say it has brought in Concerts and Voice for over 75 miles. Consists of a "Sidbenel" highly sensitive cabinet finished in chestnut, completely wired; 150 ft. copper antenna wire; porcelain insulators; 1,000 ohm super-sensitive head receiver with leather head band and telephone cord; built-in crystal detector, and complete instructions.

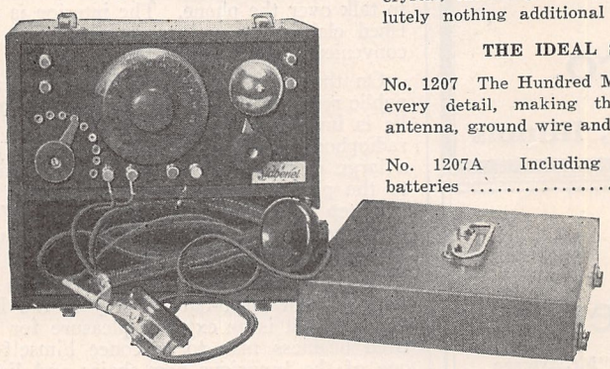
No. 1205 Price (single phone).....$10.00
No. 1205A With extra long wave tuning coil..... 11.50
No. 1205B With double phones..... 15.00
No. 1205X Without phones..... 7.75

No. 1206 A wonderful value in a high-grade set, handsome dark oak finished cabinet, double phones with leather head band, easily adjusted crystal, including aerial, long wave coil and ground wire complete, absolutely nothing additional needed.....$21.50

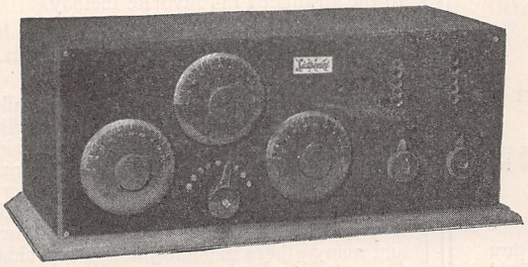
THE IDEAL SET FOR CAMPERS AND HIKERS

No. 1207 The Hundred Miler. This audion receiving set is high grade in every detail, making the finest adjustments possible. Complete with antenna, ground wire and head phones (no bulb or batteries).....$33.50

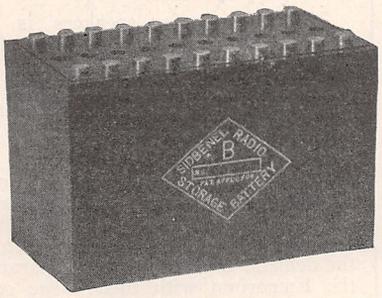
No. 1207A Including bulb and "Sidbenel" "A" and "B" storage batteries $56.50



No. 1225 "Sidbenel Thousand Miler" audion detector unit with one stage audio frequency, which is a marvel of science and workmanship, completely wired (no receivers, bulbs or batteries).....$85.00
No. 1225A With "A" and "B" batteries, two bulbs and double head receivers..$120.00



No. 200 The new "Sidbenel" heavy duty Radio storage "B" battery supplies current for a loud speaker or from 1 to 5 bulbs. A single charge lasts five times as long as the best dry battery. The singles will not fade nor will the set howl. When discharged after two to four months of constant use, you can have recharged by your nearest dealer for 35 cents, or recharge yourself. Complete details for making your own rectifier at a cost below 25 cents included with instructions for charging. "Sidbenel" "B" batteries are put up in moulded and sealed hard rubber blocks, 4½ inches long by 2½ inches wide and 3 inches deep; 25 volts each, tapped 2 volts up. For higher voltages, buy the number of blocks required. One block will supply all bulbs on the set that needs 25 volts; two blocks will supply all that need 50 volts. Price, per battery..$6.50



Pat. Pend.

IMMEDIATE DELIVERY ON EVERYTHING

Satisfaction Guaranteed or Money Refunded

Sidbenel

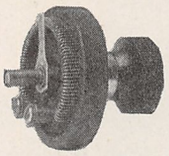
No Catalogs; Order From This Page

RADIO EQUIPMENT MFG. CO.

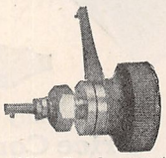
1663 Jerome Avenue, New York City

Distributors, write for territory.
Dealers, write for our proposition.

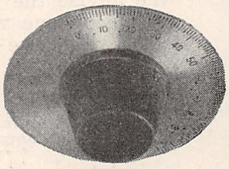
No. 212 Concert receivers, beautifully nickel-plated, with leather head band and telephone cord, 2,000 ohms. Price $6.50



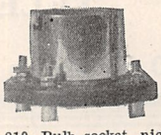
No. 208 Panel mounting rheostat complete with knob, pointers, etc. Price.....80c



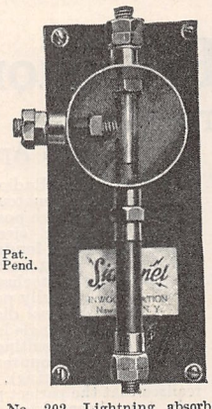
No. 204 Panel mounting switch complete with hard rubber knobs, neatly corrugated. 50c



No. 206 Hard rubber knob with ⅜-inch metal dial..75c



No. 210 Bulb socket, nickel-plated with hard rubber base, nickel-plated connections..75c



Pat. Pend.

No. 202 Lightning absorber—an absolute necessity to comply with insurance regulations, installed in 10 minutes; gives absolute protection $3.00

No. 216 Posts, heavily nickel-plated 5c

No. 218 Tap, heavily nickel-plated, ¼ in. diam. x ⅛ in., including nuts 1½c

Hard rubber panels, drilled and cut to your order 3/16 inch thick, at 2 cents per sq. in., 25 per cent. extra for drilling.

Postage extra on parts.

TELMACO

The Enormous Demand

for the

TELMACOPHONE

Is the Best Evidence That It Is the *Greatest Value* on the Market

Equipped with Baldwin Type C Unit. Inverted horn reflected tone. Equal to any other horn twice its length. Designed and perfected by expert acousticians. Complete in every detail. No extras to buy. Nothing to get out of order.

Only after the most exhaustive tests and comparisons with the other loud speakers; and only after the most thorough research, laboratory tests and field demonstrations has the **Telmacophone** been perfected.

Telmaco Amplifiers, Receivers, Detectors, Variometers and Variocouplers have earned a national reputation for quality, endurance and satisfaction not excelled by any other line. You can expect equal satisfaction from the **Telmacophone.**

Fully Guaranteed

Price Complete, $20.00

Price, without Baldwin Unit, but with cap attached.....$14.00

We advise the purchase of the **Telmacophone** without Unit for those who have Baldwin Unit of their own.

Dealers: We are distributors for nearly all standard lines. Full discounts on the Telmacophone. Write for proposition on our complete line.

RADIO DIVISION

TELEPHONE MAINTENANCE CO.

Note New Address

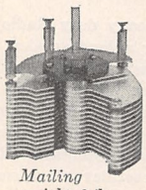
20 S. Wells Street -:- Dept. B, Chicago, Illinois

HAYNES

Precision Variable Condenser

The Condenser With a Three-fold Appeal

1. It appeals to the Radio engineer or semi-technical amateur because of its extremely high power factor in the oscillating circuit. He knows this means **louder signals and freedom from interference.**
2. It appeals to the mechanical man as being mechanically perfect; he appreciates the equal distribution of weight on the single large brass bearing, and the resulting free and smooth motion (counterbalanced on dial side of bearing). He also realizes that the perfect plate alignment could only have been obtained by hydraulically pressing the spacing washers to the smallest fractional uniform thickness.



Mailing weight, 2 lbs. Add postage

3. Lastly, it appeals to "Mr. Average **Radiophone Enthusiast**" as being a good-looking condenser at a fair and reasonable price, and one entirely worthy of a place in his new set.

Haynes Precision Condensers

are furnished in the following capacities, unmounted only, but including counterbalance:

.0011 mfd.	-	$5.75
.0005 mfd.	-	4.75
.00025 mfd.	-	3.90

Distributors Our policy is to sell only thru exclusive distributors where possible. We would be glad to send you our discount schedule and consider your proposition.

Haynes Radio Co., Inc.

(FORMERLY THE HAYNES RADIO SHOP)

629 Lexington Ave. (at 54th) *Phone, Plaza 6301* **New York, N. Y.**

AMPERITE

AUTOMATIC FILAMENT CURRENT ADJUSTER

Eliminates Rheostats. *Guaranteed to operate your vacuum tubes at maximum efficiency*

Price $1.10 mounted

Manufacturers RADIALL CO., 99 Warren St., New York

Department Store Broadcasting Station

(*Continued from page* 34)

At 2:00 o'clock in the afternoon the Emporium again has the right of way in the air and lectures by prominent people are delivered.

According to Mr. B. F. Schlessinger, general manager of the Emporium, the idea of the radio station at the store is to obtain real local talent, instead of resorting to the use of the phonograph entirely. This has been accomplished by securing many of the singers and actors from theatres in San Francisco to speak and sing over the air from the radio room. A Steinway Duo Art piano, loaned by the Sherman Clay Music Co., has been used in this respect and numerous concerts are given by well-known artists. Several of the members of the Chicago Grand Opera Co. entertained the listening public recently when the Opera Company was playing in San Francisco.

This is somewhat of an innovation, as most of the radio telephone stations in and near San Francisco make use of the phonograph only in giving concerts. To music lovers this new method offers the opportunity to hear the best music obtainable, whereas the "canned music" in time becomes monotonous.

Shortly after the station was opened a junior construction contest was held to stimulate designing and building of apparatus by the younger adherents of wireless. This contest was a decided success and many new forms of sets were built by the participants.

The transmitting room is located on the seventh floor of the Emporium Building, in a large room where the speakers are invited to talk over the phone. The interior is finished elaborately and everything is at the convenience of the speakers.

On the fourth floor the sales room and public receiving room are situated. The public is invited to come in and listen to the radiophone music in the reception room and a large crowd is always on hand listening to the phone stations around the Bay. A two-step amplifier and Magnavox afford everyone the opportunity to listen to music and announcements with ease.

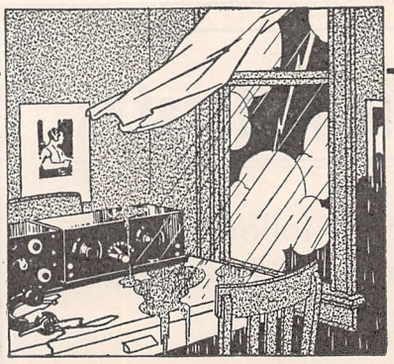
The installation at the Emporium is by far the most up-to-date of any in the Bay Cities, and it is an extreme pleasure for the tired business man to ensconce himself in one of the luxurious arm-chairs and listen to the strains of his favorite melody.

Among the prominent speakers who have delivered talks at the Emporium station are the following:

Marshal Joffre, who gave a short talk in French when he visited the city; William Hassler, health officer; Mr. Creed, President of the Pacific Gas and Electric Company; Chief of Police Dan O'Brien; Chief Murphy of the Fire Department; J. M. McCandless, Deputy Potentate of the Honolulu Shrine, and many others including actors and singers from the playhouses.

The program for speakers is arranged ahead for several weeks and every day a new speaker entertains the thousands of listeners. Letters of congratulation from all over the state have been received complimenting the Emporium's station and operators for the splendid programs offered.

That San Francisco and the entire United States are wireless mad is evidenced by the fact that the radio stores have difficulty in keeping their stocks replenished, so great is the demand for all kinds of apparatus. Even the Emporium with their large supply of radio apparatus, is having difficulty supplying the radio amateurs, who buy everything from a cat-whisker up to a two-stage amplifier and Magnavox.



Rain Won't Injure Your Formica Panels!

FORMICA does not absorb moisture so its insulating quality is never affected by weather or even by soaking in water. It does not swell or shrink and never warps. The handsome high gloss finish does not deteriorate. It looks good for years—and is good!

Formica has been approved as Radio Insulation by the navy and the signal corps. It is by far the most widely used Radio insulating material.

Formica is easy to machine, and helps you do a workmanlike job on your panel. You can buy it cut to size for a standard Radio panel. All you need to do the work is a drill.

Dealers: We supply you with display cards for your store and Formica printed matter. We cut panels to size for you if you wish—and co-operate in every way possible. Extensions to our plant have just doubled our capacity.

THE FORMICA INSULATION COMPANY
4618 SPRING GROVE AVENUE
CINCINNATI, O.

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Get a Handy Binder for your RADIO NEWS. Holds and preserves twelve issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, New York.

Chaparra "PWD" Coastal Radio Station

(*Continued from page 22*)

to sight. An umbrella antenna, sustained by a tower, 300′ high on a heavy concrete base, perfectly balanced to the extent of having no need of stays, with four branches, each 500′ long, insulated by a row of eight yards of insulators between the tower and four wooden masts, 50′ high. It is used solely for transmitting.

The receiving type is of the flat top class, stretched on to the halfway of the tower and two masts, 400′ of the former, and consists of two wires only. Both transmitting and receiving antennae are duly connected to the control apparatus in the power house. The ground system is of the direct fashion, being composed of 20 wires radially spaced from the base of the station, buried 12″ deep in moist earth and perfectly soldered and set up with efficiency.

We cannot but congratulate Mr. Valladares, the engineer, for the improvements and remarkable results obtained with such a station, which in average work, would not supersede the standard range of 650 miles daylight.

The writer has seen reliable reception from Nueva Gerona, Isle of Pines Radio Post, La Fée, Pinar del Rio, Haiti, Bermudas, Is. Bahamas, Nassau, Miami, Cape May (previously mentioned), New York, N. Y., Savannah, Georgia, Charleston, and down to Panama and Venezuela. These corresponding stations are not just around the corner, and I am quite sure a radiation of 22 amperes at 1200 meters wave-length is good for a standard type instrument of good make.

Reports on how far this station has been heard will be appreciated by the Cuban Government, Radio Department.

Radio Music to Moving Trains

(*Continued from page 45*)

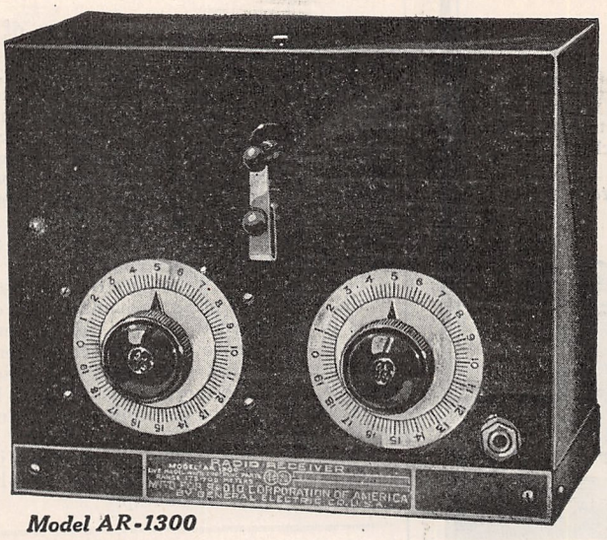
Cal. We have arranged a special concert for your benefit on this Sunday morning and will give you an hour of the finest music we can select on the first 100 miles of your long journey and hope that your efforts to establish a record for reception of broadcasting music by radio on the rear car of a passenger train while in motion will be a pronounced success. The first selection will be a piece on the player piano entitled 'Smilin' Through.'"

The music was very clear and audible to all passengers in the car and to their friends and relatives on the platform in rear of car and was distinct and clear to those left at the station until the train was well on its journey. Several records were played on the phonograph at the Los Angeles Kinema Station and we were in touch with the music at all times during many variations of speed and rounding of curves during the entire concert and could distinctly hear the operator's announcement of the various selections of music.

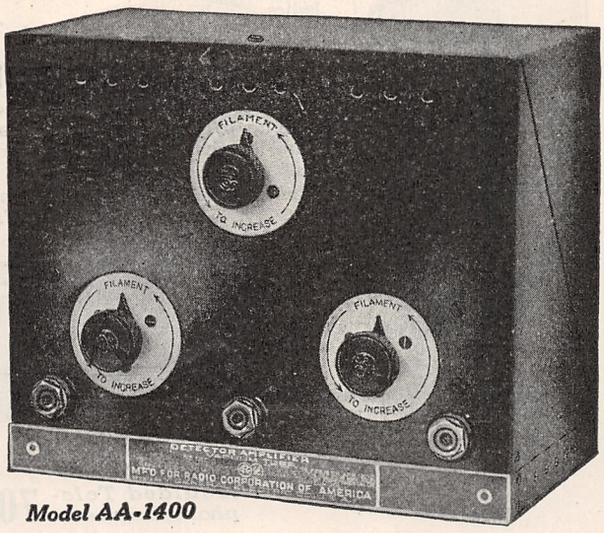
With a higher and better insulated antenna it is quite probable that these broadcasting stations can be kept in tune for a considerable distance from the city.

As is the usual experience in telephoning, the higher pitched tones of women's voices

Crystal or Vacuum Tube Detection with the same set



Model AR-1300



Model AA-1400

These two sets (radio receiver Model AR-1300 and Detector Amplifier Model AA-1400) meet the demand of the novice who wishes to start with a simple crystal detector and later to pass on to vacuum tube detection and amplification at minimum cost.

Radio receiver Model AR-1300 is a new tuner for the broadcast enthusiast. Used as a crystal detector it is a complete receiver. Used with Model AA-1400, here shown, the crystal detector is switched off and amplification is controlled by regeneration.

Detector Amplifier Model AA-1400 consists of a vacuum tube detector and two stages of audio-frequency amplification. It is especially adapted for use with receiver Model AR-1300 to increase the strength of broadcasted concerts. The individual filament control permits close regulation of the received energy. Distortion of broadcasted music is avoided by a special high-frequency resistance across the secondaries. Three telephone jacks insure ideal selectiveness ranging from simple tube detection to two stages of amplification.

PRICES (NOT INCLUDING ANTENNA, TUBES, AND BATTERIES)

Radio receiver Model AR-1300	*$50.00*
Detector Amplifier Model AA-1400	*75.00*
Total for Combination	*$125.00*

See these New G. E. Products at Your Nearest Dealer

Radio Corporation of America

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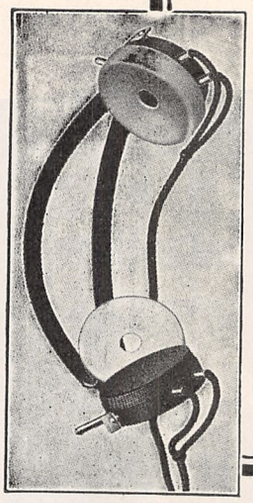
Sales Department, Suite 1802
233 Broadway, New York City

Radisco Unbreakable Ivory Ear-Caps

(For Murdock Phones)

Sanitary, beautiful in appearance, light in weight, cool in summer. Dirt can be wiped off with a damp cloth. If the young men in the house do not appreciate the artistic appearance of these ivory ear-caps, they—at least—should be used for the benefit of the ladies.

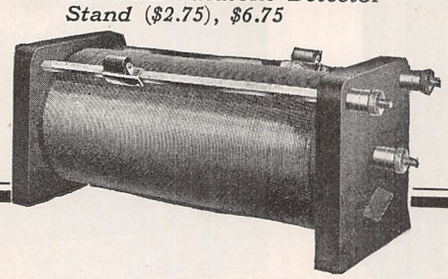
Price, 75c Each

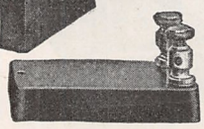


TWO-SLIDE TUNER

The Radisco H & M Two-Slide Tuner will tune up to practically all the broadcasting wave-lengths. Moulded ends and first-class construction throughout.

Price $4.00. With Puratone Detector Stand ($2.75), $6.75

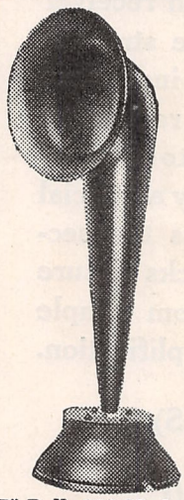




Moulded Telephone Condenser **70c**

RADIO DISTRIBUTING CO. **NEWARK, N. J.**

RADISCO



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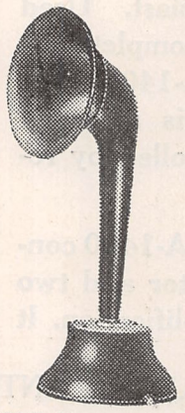
We figure on *Special* Horns for *Manufacturers.*



7″ Bell, 19″ High
No. 17
Price $7.50

5″ Bell, 14″ High
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Standard Metal Mfg. Co.

Oldest and largest manufacturers of Horns in U. S.

237 Chestnut Street **Newark, N. J., U. S. A.**

IF YOU CAN'T READ

Dots and dashes you are missing the most important and interesting part of radio receiving. Continental Code Chart as used by author in teaching, is the surest, quickest and most reliable way of learning. $1.00, no stamps.

E. A. NIELSEN **Box 67, Waverley, 79, Mass.**

came more clearly than the average male voice. Records of soprano singers were unusually clear and distinct.

The value of the entire outfit is estimated at $700.

Portraits Radiated Through the Ether

(*Continued from page* 23)

board, will record a minute square of corresponding shade, thus reconstituting, element by element, the original picture.

About one thousand words are required for a portrait; a special code, however, enables this to be reduced to three hundred words. From a wireless station, a given photograph can simultaneously be sent to any number of other radio stations (also to ships on the high sea), if these, in addition to an ordinary radio receiver set, comprise a typewriter such as above described.

This method will find useful applications in the illustrated press, in banking and other lines of commercial activity, for the broadcasting of meteorological bulletins, for advertising and, alas, for military purposes as well. One of the most important uses, however, will be for the purposes of the criminal police, portraits of criminals being, in a minimum of time, circulated broadcast in all directions and to any distance, and being even received on board ship.

A Relay Recorder for Remote Control by Radio

(*Continued from page* 51)

frequency current in the plate circuit caused the relay armature to chatter rapidly and make a poor contact with the fixed contact point through which the circuit is closed. This was overcome completely, however, by the addition of a one-microfarad condenser across the relay coils. This served the purpose of an audio-frequency by-path for the highly inductive winding of the relay, thus greatly decreasing the resistance of the circuit. The change of plate current due to this audio-frequency caused a second change which occurred at the keying frequency. This latter change passes readily through the relay coils and exerts a strong steady pull on the relay armature without chattering.

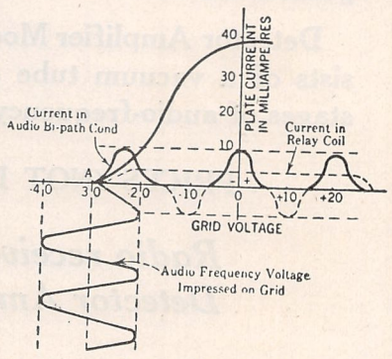
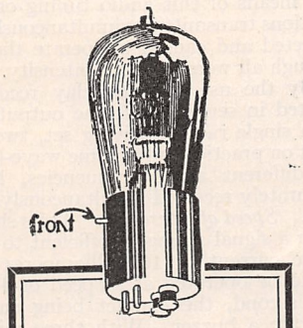
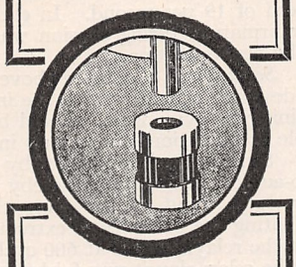


Fig. 2—Tube Characteristic Showing Principle of Operation of Relay Recorder.

It was also found that the 0.0006-microfarad variable condenser, Fig. 1, across the secondary of the input audio transformer made possible audio tuning, which increased the selectivity considerably. This tuning was very sharp and it was found that European stations could be made to operate the relay while a high-power station here in the United States would fail to operate it, although the high-power station was coming in on the same wave-length and slightly stronger. This was made possible by adjusting the heterodyne note of the European station to a frequency different from that of the local station and then tuning the secondary of the audio trans-



Absolute Protection



Carrying Capacity

½, ¾, 1, 1¼, 1½, 2, 2½, 3 amperes

The Biggest Little Thing in Radio

Right now with tubes not only expensive but *hard to get*, it is mighty important to insure the life of every bulb with the

RADECO SAFETY FUSE

(PAT. PENDING)

for VACUUM TUBES, METERS and other DELICATE INSTRUMENTS

Fitting directly on the filament terminals of any standard tube used in any standard socket, this tiny device makes "burning out," even from accidental high amperage, absolutely impossible.

The Radeco Safety Fuse is positive in its action and does not affect the efficiency of your set. It is easy to attach, is easily replaced, and so far as your tube is concerned guarantees continuous use of your set.

Come only in packages of four **4 for $1** *Order by mail or from your dealer*

***DEALERS:** The Radeco Safety Fuse is selling "red hot." Order now for delivery*

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CLAPP-EASTHAM HR REGENERATIVE RECEIVERS

In Oak Cabinet **$35**

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Biggest Value on the Radio Market

SPECIAL CRYSTAL DETECTOR SETS

Complete with Variable Condenser, Vario Coupler, Tapped Primary, Buzzer Test, Cord Tipped Jacks for Phones, Bakelite Panel and Grade A Crystal **$20**

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UNIT VAR. 45 V "B" - - **$3.60**

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DICTOGRAPH HEADSET

For years we have been the largest manufacturers of "watch case" receivers in the world. We have made these super-sensitive sound receivers for use in the most difficult situations. In noisy offices and in vital detective work Dictographs have proven the clearest, most sensitive sound reception instruments known. Backed by years of this experience we have produced the new Dictograph Radio Headset.

Here, at last, is the headset that gives you clear, distinct tones—that reproduces perfectly the most sensitive radio signals in music, speech and code. Try it, at your dealers. Be sure it's the Dictograph. Covered by the Dictograph guarantee.

Made by the makers of the most sensitive sound reception apparatus.

DICTOGRAPH PRODUCTS CORP.
Charles H. Lehman, President
220 West 42nd St. New York City

3000 OHMS

PRICE **$12**

former to that frequency. The 0.0006-microfarad variable condenser may be replaced by a 0.0003-microfarad fixed condenser and the audio tuning accomplished by adjusting the heterodyne note to the resonant frequency. By means of this audio tuning one of three stations transmitting simultaneously has been selected and caused to operate the relay, although all were of equal intensity.

By the use of two relay recorders connected in series across the output terminals of a single radio receiving set, two messages sent on practically the same wave-length, but of different audio frequencies, have been accurately received simultaneously.

6. *Speed of Operation.* Tests showed that with a signal strength sufficient to produce a plate current of 10 milliamperes the relay could be operated at a speed of 48 contacts per second, the contact being sufficient to operate a buzzer. With three milliamperes in the plate circuit a speed of 27 contacts per second was obtained. With one milliampere a speed of 19 per second. In each case the relay armature spring tension was adjusted for the best operation.

7. *Sensitivity.* As stated above, this relay was designed primarily with the intention of obtaining a device which should be durable, simple in operation, and strong in construction. Sensitivity is obtained by means of radio-audio amplification thereby increasing the voltage input to the relay circuit and eliminating the necessity of extreme sensitivity in the relay. Tests at 600 cycles showed that the relay circuit was fairly sensitive, as approximately 1.3 volts at the input terminals of the audio transformer in the relay circuit caused a current of five milliamperes to flow through the relay coil in the plate circuit.

8. *Durability.* As the relay instrument used in this recorder is of the ordinary telegraph type its durability is well established. The only elements requiring occasional renewal are the two electron tubes, the 60-volt "C" battery, and the 160-volt "B" battery.

9. *Portability.* The complete recorder with the exception of the filament lighting battery is contained in a cabinet 7″ by 13″ by 11″, as shown in Fig. 4.

10. *Uses.* 1. As an ordinary receiver it has advantages over reception with telephone receivers, for one may receive by buzzer or sounder with all induction and interfering noises eliminated (if not louder than the signal).

2. A tape or drum-type recorder may be used and a copy made without a trained radio operator.

3. Time signals may be recorded.

4. A call system may be worked by a time switch connected to close the filament circuit for a given time at set calling intervals.

5. Any form of mechanism may be operated by an incoming signal.

6. A receiving station may be located remotely from the transmitting station and the radio signals relayed by wire to the operating room some miles distant.

In conclusion it may be stated that a relay of this type should operate satisfactorily, *without attention*, on an airplane where mechanical vibration may be excessive as the pull on the armature with three milliamperes, or over, in the relay coil makes possible the use of a spring tension on the relay armature sufficient to keep it from moving due to mechanical vibration of the relay.

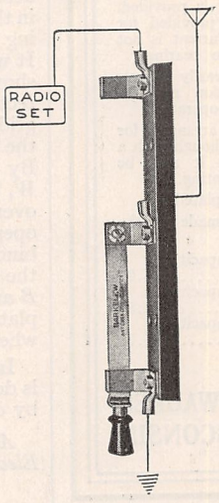
It would seem that the above-mentioned feature makes this remote control relay more serviceable than those now on the market which require delicate adjustment of spring tension, contact points, and suspended vibrating elements.

Type B—For Use on the 60-Cycle, 110-Volt, A-C. Supply

This recorder is similar in construction and operation to the Type *A* recorder, except that the plate and grid voltages (B and C battery) are supplied from the 60-cycle, 110-volt a-c. supply. The current for operating the tube filaments is also obtained from this source,

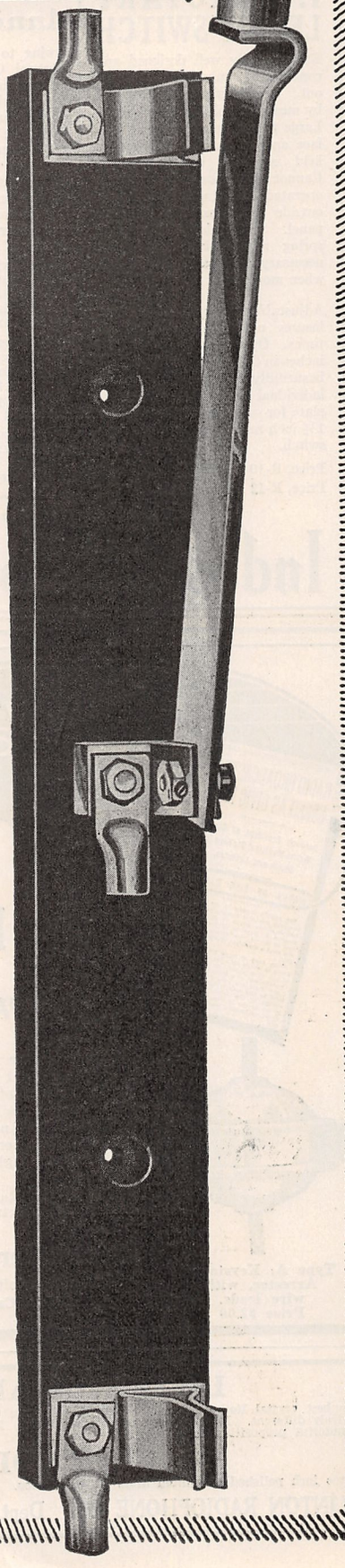
BARKELEW

Radio Ground Switches
For Lightning Protection

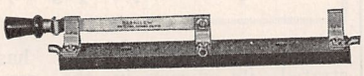


Disconnect the Radio Set

Ground the Antenna

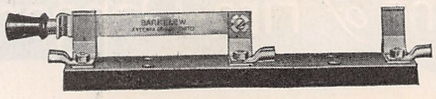


Use a Knife Switch—You Can See It Work



Cat. No. 600—Price $2.50

Low in price, compact, well built. A switch that will stand all ordinary usage. Copper Parts, 60 Ampere Stock. Ebony Wood Base Break 5 inches.



Cat. No. 601—Price $3.15

A heavy, rugged switch for use in schools, public buildings.

Copper Parts, 100 Ampere Stock Ebony Wood Base. Break 5 inches.

Both Switches fully meet the latest requirements of the National Electric Code and are approved and listed by the Underwriters' Laboratories.

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Discounts To Electrical and Radio Distributors.

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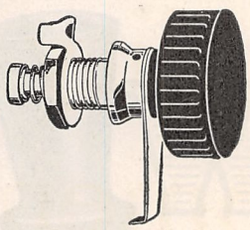
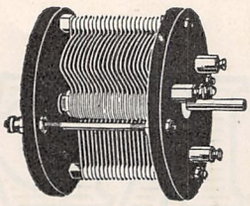


I-C

THE MARK OF QUALITY



I. C. ROTARY LEVER SWITCH

Exceptionally well designed and constructed; substantial throughout. Switch is secured to panel by means of holding nut at back. Large flange presents ample surface against panel. Terminal is held securely under bearing. Cannot turn when switch lever is operated. Bearing is threaded on outside and extends through panel. Switch designed to clear spring and spring lock. Not necessary to disassemble switch when mounted.

Adjustable spring at end of shaft insures uniform tension at all times. Operating knob is 1 1/16 inches in diameter. Nickel plated; beautifully finished. Packed in individual boxes. Drilling template for contacts of 1 inch, also 1½ inch radius accompanies each switch.

Price, R-10 Radius 1"..... $0.75
Price, R-12 Radius 1½"..... .75

Announcement

Owing to the fact that the Industrial Controller Co. has had an unusually wide experience in the manufacture of apparatus for radio equipment; also the fact that their manufacturing facilities are particularly suited to specializing on certain parts of radio equipment, this company is placing on the market a quality line of condensers, switch parts, and other apparatus as used in amateurs' small receiving sets.

These devices are featured by the same quality and high-grade workmanship which has always characterized I. C. products; yet they are offered at a fair price.

For a number of years, the U. S. Government, also many of the large radio companies, have used, in connection with radio equipment, apparatus built by the Industrial Controller Company.

In purchasing I. C. equipment, you are assured substantial construction, practical design and satisfactory results.

I. C. VARIABLE CONDENSER

Substantial construction in every detail. Movable plates carried on a large hexagon shaft; separated by accurately machined spacers. Holes in plate are hexagon, and fit closely to the shaft, insuring correct alignment of the plates.

Bearings are large. An adjustable thrust bearing is provided. Sliding contact is provided for movable plates. Current is not carried through the bearings.

Tension spring is easily adjustable so that tension may be changed to suit the operator.

The condenser is arranged for panel mounting, although with a very slight change it may be used for table mounting.

All parts are nickel plated.

The condenser is made in the following sizes:

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R-55—23 plates, capacity .0005 MFD..... 4.50
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See Your Dealer

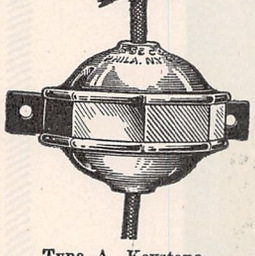
Industrial Controller Co. MILWAUKEE WISCONSIN

KEYSTONE RADIO ARRESTERS

Approved by Underwriters

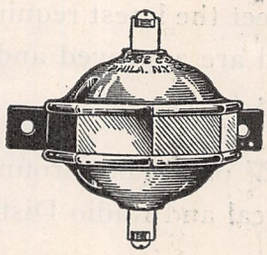
To protect your radio apparatus and your property against lightning and to take off static accumulations. Can be installed outdoors where a lightning arrester belongs, highly efficient, no vacuum to lose, no fuse to blow, offers permanent protection. Takes the place of a lightning switch.

For sale by Radio Dealers, Department Stores and Electrical Dealers everywhere.



Type A, Keystone Arrester, with wire leads. Price $2.00

Electric Service Supplies Co.
Mfrs. of Lightning Arresters for 30 Years
17th & Cambria Sts., Phila.



Type B, Keystone Arrester, with binding posts. Price $2.00

LATEST RADIO SENSATION

The best crystal Radio set on the market. A sensation to Radio. The neatest, most compact and efficient. Built entirely different. Must be seen to be appreciated. Retail price, $35.00. Sample sent prepaid on receipt of $21.00. Wonderful proposition to jobbers and dealers.

RADIO DIALS

Three inch polished aluminum dials without knobs. 0 to 180 scale reading. Price, $12.50 per hundred.

CLINTON RADIOPHONE CO., Dept. A, 29 S. CLINTON ST., CHICAGO, ILL.

so that the recorder is operated entirely independent of any form of batteries. It is only necessary, therefore, to connect to the 110-volt a-c. line and the recorder is ready to operate.

The method of operating the recorder from the a-c. supply consists in the use of the two receiving tubes as rectifiers as shown in Fig. 5. The tubes *Y* and *Z* are used as half wave rectifiers, one supplying the plate voltage, and the other the grid voltage. When used as rectifiers, receiving tubes should have the grids and plates electrically connected together. A special transformer *M* with six windings is used. Two of the windings *G* and *J* supply the filaments of the two rectifier tubes. A third, *I*, the filaments of the recorder tubes. A fourth, *U*, the high voltage for the plate. The fifth, *L*, supplies the grid voltage, and he sixth, *E*, is the 110-volt primary winding. The rectified alternating current is smoothed out by means of four microfarad condensers *P* and *R*, connected across the output terminals. As the currents in the grid and plate circuits are small, smoothing out inductance was found unnecessary. It was found necessary to put 40,000 ohms as shown at *O*, across the output circuit of the rectifier tube supplying the voltage to the grid, as the grid is otherwise insulated from the filament of tubes *K* by the rectifier tube. By means of the filament rheostats, *X* and *W*, the grid and plate voltages may be varied over any ranges desirable for the most efficient operation of the recorder. By the use of binding posts with straps as shown in Fig. 6, the type *B* recorder may be operated from *A*, *B* and *C* batteries for supplying the filament, plate and grid voltages respectively in cases where the a-c. supply is not available.

In cases where very high-speed operation is desired, the ordinary relay may be replaced by one designed for high-speed operation.

Abstracted from the Journal of Institute of Electrical Engineers, April, 1922.

Universal Amplifier Invented

(*Continued from page* 32)

The experimental unit has demonstrated its efficacy in the reception of communications from spark stations, of medium power consumption, as far distant as Boston. And, strange to say, a coil only five inches in diameter was effectively employed as the receiving antenna. This small coil is seen on the table along with the amplifier in the photograph reproduced herewith. The signals when thus transmitted from Boston to Washington were audible several feet from the head telephones. The model, which will serve as a copy for quantity production, is on exhibition in room number 407 of the East Building of the Bureau of Standards, where the naval radio research laboratory was recently provided equipment and space for studying vacuum tubes.

"While the amplifying qualities of the three-electrode vacuum tube have long been known and used," to quote an official statement of the United States Navy Department, "yet heretofore the amplifiers obtainable would amplify only incoming signals over a narrow band of wave-lengths. It is desirable, however, to have apparatus which will receive over a very wide range of wave-lengths, and the amplification should be as strong in one region of wave-length as in another, if it is to be universal." The amplifier designed by Dr. J. M. Miller, according to claims, successfully answers this criticism lodged against former designs of amplifiers. The details of this mechanism, other than those disclosed in this article, are not forthcoming until the patent that is pending has been granted, or otherwise disposed of.

Put Prest-O-Lite Quality Into Your Radio Equipment

What the name, *Prest-O-Lite,* means to the automobile, it means to radio. Embodying the same battery principles and the same standards, the Prest-O-Lite designed especially for radio use delivers regular Prest-O-Lite satisfaction.

For summer months, it is without a rival. Its continuous, even rate of discharge eliminates necessity of continual adjustment.

A tasteful piece of cabinet making in mahogany finish, it harmonizes with any furnishings. Equipped with rubber feet, it does not deface furniture.

The Prest-O-Lite is beyond question the foremost battery for radio use. Ask for it at any Prest-O-Lite Service Station; or your electrical dealer will get it for you. **Prices $15.75 to $37.50.**

We advise the selection of the battery of ample capacity to avoid recharging. When it needs recharging, remember there is a Prest-O-Lite Service Station in your vicinity.

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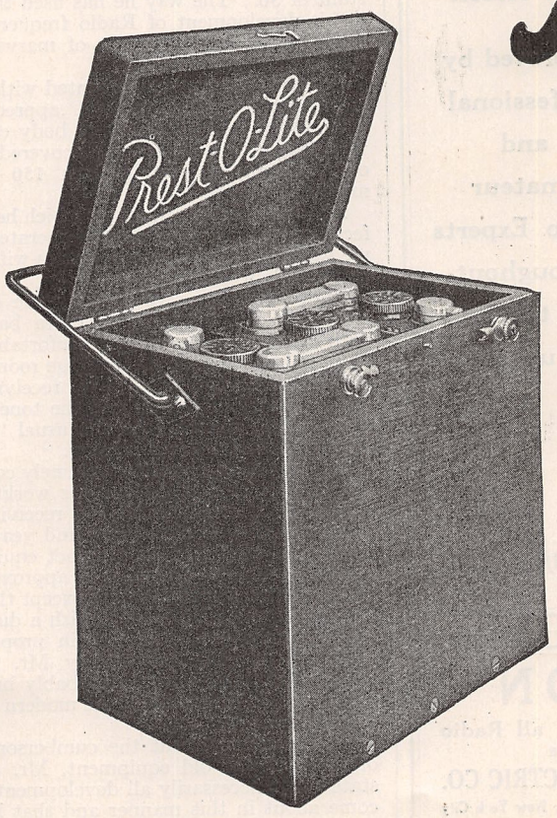

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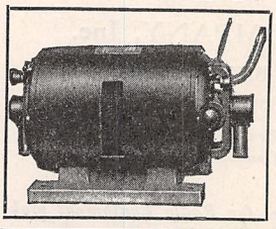

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Loud in tone

—

Sensitive to weak signals

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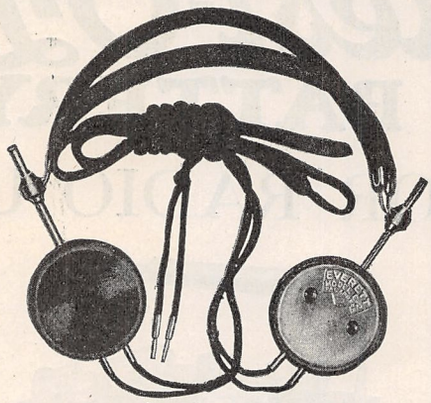
Will withstand amplification without distortion



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BEACON

Can Supply You with all Radio Parts and Sets

BEACON RADIO & ELECTRIC CO.

246 Greenwich St., near Park Place, New York City

Ogontz Police Auto Now Carries Radio

(*Continued from page 32*)

covered. He is also the inventor of a device by which it is possible to telephone to and from moving trains.

The wireless will soon be installed throughout the township. At the present time communication extends through Ogontz, Elkins Park and Ashbourne. When the installation is complete the districts affected will include Cheltenham, Melrose, La Mott, Wyncote, Glenside, Edge Hill, Oak Lane Terrace and Wyndmoor.

Who's Who In Radio

(*Continued from page 65*)

which the reports of the Dempsey-Carpentier fight were broadcasted, is the original tower of Mr. Myers' broadcasting station and which was sold by him to the Delaware and Lackawanna Railroad.

When the War came on and our boys on the other side were in need of Radio Equipment, the Western Electric Company called on Mr. Myers to take charge of production of "J" tubes. He raised the output of the plant from 150 to 5,000 tubes per day in seven months.

What impressed me most about this man was the fact that he spends little or no time in abstract theory. All his efforts seem to be given to the actual perfection of something useful and practical, for the advancement of radio. Where others have spent their time in developing theories of operation, Mr. Myers devotes his energies to the production of something tangible, something the other man can make immediate use of, something by which radio, as a science and practical industry, benefits.

One of the interesting evidences of this fact is the tube which he uses and manufactures. This tube he says has an amplification constant of 30. The way he has used this tube in his development of Radio frequency amplification is nothing short of marvelous to the uninitiated.

Anyone who has experimented with Radio frequency amplification will appreciate it when I say that all effects of body capacity were removed and that the set covered a band of wave-lengths ranging from 150 to 800 meters.

Another piece of apparatus which he is perfecting is a loud speaker. He operated it for me while I was in his laboratories with truly remarkable results.

The device operates on only the current from the set, requiring no extra batteries, with such volume as to be uncomfortably loud in any place short of a very large room—and this with only two tubes in his receiving set. There was no distortion and the tone reproduction was perfect. All the usual "flash" of amplified sound was missing.

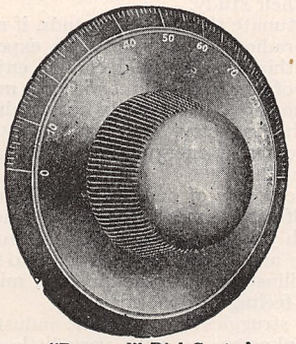
On remarking upon the extremely compact set with which Mr. Myers was working, he laughingly showed me an old receiving apparatus which he used years and years ago. Compared with modern compact equipment it was ludicrous. In effect it approximated the present day vario-coupler except that the larger coil was fully 2′ long, with a diameter of 12″, while the rotor was in proportion. With all its apparent crudity Mr. Myers stated that this set would probably bring in better signals than most of the modern equipment of today.

On remarking about the cumbersomeness of much of the old equipment, Mr. Myers stated that necessarily all development must come about in this manner and that he felt that he, like many others, owed a great debt

The BENWOOD RADIO Co. INC.

"WORLD-WIDE MAIL ORDER SERVICE"

EVERY item on this page is manufactured in the Benwood factory—under the supervision of radio experts. If there is no "Benwood" dealer near you, order direct by mail—get the biggest values for your money, satisfactory apparatus and prompt service.



"Benwood" Dial Control

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The New, Improved "Benwood" Dial Controls

The "Benwood" dial controls all have solid Bakelite knobs of extra large diameter, which minimize all bodily capacity effects, and the new tapered design fits the fingers of the operator perfectly. The knurling is particularly fine and sharp, affording an excellent grip.

Solid Bakelite Knob and Dial

Graduated 0° to 100°—all markings clearly defined in white and stamped into the solid Bakelite—won't wear off. Rib on reverse side prevents turning too far. Set screw deeply countersunk and easily reached.

		Diam.	Depth	Knob	Each
BC-7	"Benwood" control	4"	1⅜"	2" at base	$2.00
BC-8	"Benwood" control	3¼"	1 3/16"	1⅝" at base	1.75

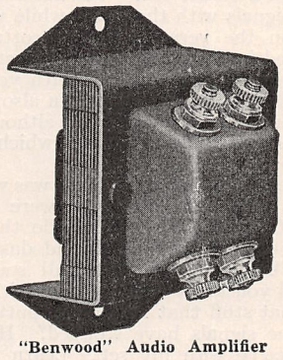
Specify whether ¼" or 3/16" drilling is required.

Solid Bakelite Knob—Metal Dial

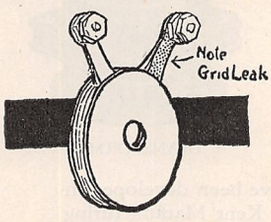
Has the same tapered solid Bakelite knob as BC-7 and BC-8, but has metal dial. **Finely graduated from 0° to 180°.**

		Each
BC-9N	"Benwood" control—Nickel-plated 3 5/16" Dial	.80c
BC-9	"Benwood" control—Black Metal 3 5/16" Dial	.80c

Specify whether ¼" or 3/16" drilling is required.



"Benwood" Audio Amplifier



The Ideal Condenser for Every Purpose

Make your own grid, phone, filter, antenna, tapped or variable condenser at exactly the right capacity for your individual set. The Benwood "Universal" condenser is an assembly of mica washers and thin copper plates with lugs attached, held together by two brass end plates and machine screw through the center.

Use 2 plates for grid and combine grid leak as shown, 10 plates for phone, 35 for filter, or vary to get best results. Standard set of six plates and ten washers. Price, $1.00 per set. Extra set of ten coppers and ten mica washers, giving additional capacity of approximately .0005 mfd. Price, 40 cents per set.

The Only Practical CW Panel Inductance

This is the only CW Inductance made for panel mounting. The copper ribbon is wound on FORMICA supports, giving highest possible insulating qualities. Each Inductance furnished with four of the new type BENWOOD PATENTED HELIX CLIP, which will fit either a round or flat surface. Each clip furnished with moulded insulated handle which enables tuning of the set with current on.

Standard size, as shown in cut, consists of 25 turns of edgewise wound soft drawn copper strip ⅜ inch in width and 1/16 inch in thickness. Turns are full 6 inches in diameter. Type A-1 (as shown)—each $8.50. Type A-2—50 turns, ideal for stations requiring more than 250 meter wave, price, each $12.50.

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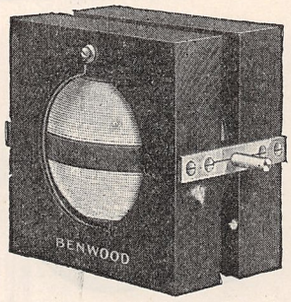


"Benwood" Variometer

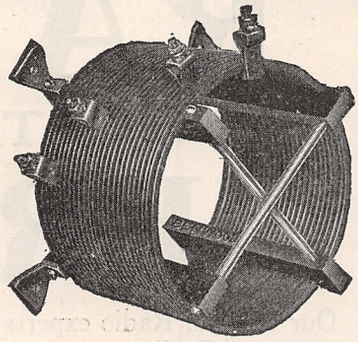
FINER TUNING

Phone Signals Louder and Clearer

A properly designed variometer brings in signals very much louder and clearer than the various other types of inductances on the market. With this fact in mind we have designed the "last word" in variometers—the "Benwood." Inductances are wound with double cotton covered wire and no shellac, paint or varnish is allowed to cover the wire and diminish the effectiveness.

The "Benwood" features are—minimum distributed capacity, minimum distance between stator and rotor, large size wire on both coils, positive contact bearings and proper design. This variometer will get splendid results on wave lengths from 150 to 650 meters when used with the average vario-coupler.

Price, each..... **$5.00**



"Benwood" CW Inductance

Full 4 to 1 Amplification—Without Howling or Squealing

The new Benwood Transformer is especially made to get maximum amplification when used with any bulb on the market.

It is completely sheathed in metal, avoiding all inductive effects, so that it gives full 4 to 1 amplification without howling or squealing. The base is 2⅝"x3⅜", height only 2"—ideal for either base or panel mounting. The core is best laminated steel, giving highest transference of energy—it will bring in your signals loud, strong and clear. The "Benwood" Amplifying Transformer, each..... **$5.00**

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Enclosed is 10c. in stamps —please send me your up-to-date catalog and latest prices.

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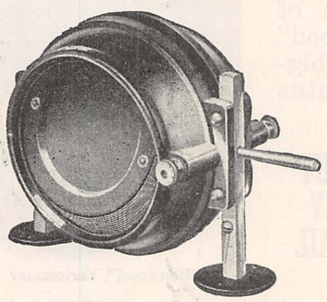
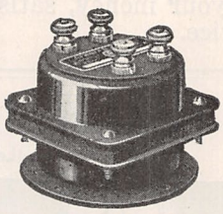


VARIOMETER



TRANSFORMER

THESE Variometers and Transformers have been developed in the research laboratory of the Atwater Kent Manufacturing Company. Twenty years' experience in the manufacture of electrical instruments of accuracy and precision, assures the highest possible standard of quality and performance in these sets.

Manufactured complete in our own plant, from the moulding of the condensite forms to the winding of the fine wire coils.

Correspondence solicited

ATWATER KENT MANUFACTURING COMPANY
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Our corps of Radio experts are now designing and building improved Radio apparatus and we want every Radio fan on our mailing list so that we can send literature covering our apparatus as developed. Kindly state the type of set you have or contemplate installing and give us the names and addresses of your Radio friends so that we may place their names on our mailing list.

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to the vast number of unknown amateurs who had purchased and used these crude devices in the past. He said that many of these men were just as tireless in experimental work as those who had been more fortunate in being able to devote all of their time to Radio as a business.

Also realizing that many who use vacuum tubes do not entirely understand their operation, he has prepared an elementary explanation of their action in the form of an elementary discussion which he hopes may be of service to those who would utilize his experience in their study.

It is unfortunate that the thousands, if not millions, of radio amateurs who are experimenting in this alluring field cannot enjoy the privilege of personal contact with this man who, while he is one of the truly outstanding figures of the industry, devotes his entire time, resources and energy to practical accomplishments.

During the course of one brief talk he excused himself three times to personally meet and talk with young amateurs who had problems to solve and knew whom to come to for help. This illustrates the broadness of mind and "fellow feeling" of the man.

His early struggles in an infant industry sailing an unknown sea with very little experience behind him in no way has hardened him, but has rather developed in him a sense of altruism that makes him ever ready and willing to drop profitable employment and devote his time to the good of the cause.

It is on the work of such "Amateurs" as Mr. Myers that Radio has come into its own and must go on and on to greater and greater accomplishment for the good of the human race.

Suggestions for the Summer

(*Continued from page* 65)

not already initiated. Ask any young man or boy who holds a Federal license what the best part of wireless is and he will tell you that it is being able to communicate by means of dots and dashes with the fellow across the street; the fellow across the town; the fellow across the state; the fellow across the continent, and then the fellow across the water. The new fraternity is the Freemasonry of Radio. There is already talk of agitation for a Universal language so that people all over the world may listen to broadcasts and communicate with fellow-men in any part of the world. War will be still farther away where this is possible.

To come back to our subject, why not learn the International Code during the summer? We can all take portable sets to the woods and the seashore this summer and listen in between the bursts of static. Take a telegraph key and a buzzer too. You can make dandy code signals with them and while you are sitting on the veranda of the cottage waiting for bedtime to come you can practice code and carry on conversations with your friends in dots and dashes. You can also do this by means of a pocket flashlight, although this trains the eye and not the ear, which is bad for radio.

Have you ever wondered who that was who "butted in" with code when you were listening to WGY or KDA? What do these folks say to each other in dots and dashes anyway? What does the SOS call sound like? Would you know it if you heard it?

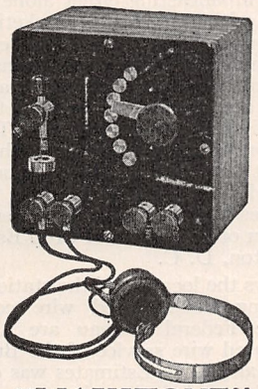
What is that stuff that Arlington sputters after the time signals have stopped? How far can I receive with my set? Learn the code; be able to answer these questions yourself; interpret code messages for your friends and mystify them by your ability to understand the new language; come out of the kindergarten stage and get into college.

Radio is not a fad; it is here to stay. Get a good start now and be an old-timer next winter when the biggest developments of radio arrive.

RADIO MAXITONE TRADE MARK REG. PRODUCTS

Announcing Maxitone Radio Products

Highest Possible Quality at Popular Prices



"MAXITONE"
Radio Receiving Set No. 1

Exceptionally compact and beautifully finished. Genuine Condensite panel front. Mahoganized case. Equipped with the wonderful new super-detector "Maxitona." Knurled knobs. Seven-point switch for fine tuning. Single phone, headband and cord. Set complete with aerial, ground wire, etc.

Price, $17.50

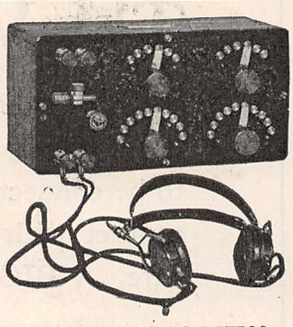
This announcement is of keen interest to both radio enthusiasts and dealers alike. It heralds the arrival of the first complete line of thoroughly high grade radio receiving outfits at popular prices. The new Maxitone line at once creates a new standard in quality and in price.

Maxitone radio instruments have been designed by well-known radio-telephony engineers and are built by an old organization, long skilled in the manufacture of delicate electrical apparatus. And every Maxitone product is backed by an absolute guarantee of satisfaction.

"MAXITONA"
The Super-Detector

Maxitona is far superior to the many "crystal" detectors now in use and is used exclusively in all Maxitone instruments. We are the sole distributors of this wonderful new detector and those wishing to replace their present "crystals" with Maxitona may order direct from us, using coupon below.

Price, 35 Cents



"MAXITONE"
Radio Receiving Set No. 2

Here is the most advanced radio "crystal" type set on the market. This remarkable instrument is equipped with four seven-point switches for extra fine tuning, with a consequent clarity and strength of signals that is a revelation. Equipped with the wonderful new super-detector "Maxitona." Genuine Condensite panel front. Mahoganized case. Knurled knobs. Double head phones, 3,000 ohms, and cord. Set complete with aerial, ground wire, etc.

Price, $30.00

Maxitone Bulb Type Detector With Two-Stage Amplifier, $75.00

Here is the most remarkable radio announcement of the year. Think of it—a vacuum tube type detector cabinet of superb quality at the remarkable price of.....$37.50
This new Maxitone is built so that its range of wave length can be materially increased as necessary by simply installing a loading coil at the cost of only $2.00. Necessary posts are installed as standard equipment, so there is no additional expense or remodeling necessary. This feature will be of utmost value to the owner should the broadcasting stations throughout the country be placed on a higher wave length.
The Maxitone Detector Unit, without the Amplifying Unit, has a range of at least 100 miles, even under adverse conditions. Its wave length range (without the additional loading coil) is from 150 to 800 meters.

The Maxitone Two-Stage Amplifying Unit, while intended primarily for use with the Maxitone Detector, may, however, be used with any bulb type detector. This new Maxitone instrument is of the same high standard of quality as the detector unit and offers the utmost in radio-telephony advancement and results. An important feature of this Maxitone radio set is that it is equipped with Filament Control Jacks. This means a decided saving on your battery and tubes, as by this feature the bulbs are automatically operated and do not use current when not in actual use.

Price, Only $37.50

Both Detector Unit and Two-Stage Amplifying Units for Only $75.00

DEALER'S OPPORTUNITY!

The remarkable new line of Maxitone radio receiving sets and supplies offers an exceptional opportunity for a limited number of high-grade dealers. Our policy is "The highest possible quality at popular prices." We absolutely guarantee every Maxitone product. The opportunity to secure such a sales franchise as the Maxitone is rare. If you are interested in the tremendous possibilities of a complete line of quality apparatus at lowest possible prices, send in the Dealer's Coupon below—**right now.**

IMMEDIATE DELIVERIES

Detroit Radio Company, Inc.
1036 Beaubien Street
Detroit, Michigan

Detroit Radio Co.,
1036 Beaubien St., Detroit, Mich.

Enclosed find 35c for which send me at once a Maxitona Detector.

Name.....
Street.....
City.....State.....

"MAXITONA" COUPON

Detroit Radio Co.,
1036 Beaubien St., Detroit, Mich.

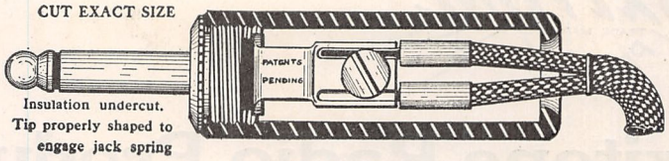
Please send me without obligation complete information regarding the Maxitone line.

☐I am a dealer. ☐I am not a dealer.

Name.....
Street.....
City.....State.....

DEALER'S COUPON

CUT EXACT SIZE



Insulation undercut. Tip properly shaped to engage jack spring

Black finish, non-breakable, round, one piece handle not affected by body capacity; no screws used to hold handle in place.

The WACO PLUG

The latest development in plug design. Fits every radio jack and permits two phone sets to be connected at the same time. Positive contact with any type of cord terminal or wire. A BIG SELLER.

This is only one of many improved specialties we are offering. DEALERS: Write for Stock List and Catalog.

Wireless Appliances Co.
315 Old Colony Bldg.
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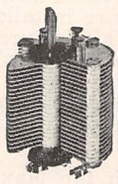
KLEIN RADIO & ELECTRIC SUPPLY CO.

Specials for July



Variable Condenser

Full capacity, well-made condenser.

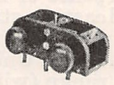
Price (11 plate), $2.50
Price, No. 106 (23 plate)..... $3.00
Price, No. 105 (43 plate)..... $3.75

Galena Crystal Detector

of sterling merit; beautifully made.

Price { With Crystal..... $1.00 / Without Crystal.... $ .75

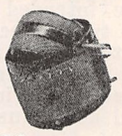
3-Coil Mounting



A neat, well-made little article. Binding posts easily reached, acting also as legs.

Price, each.... $5.00

A Good Variocoupler

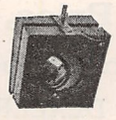


Neatly finished; well made; of decided merit. No. K-104.
Each..... $5.00

Variometer

A well-made instrument, embodying many improvements.

Price, each....$5.00



We give prompt and careful attention to mail orders. Write for price list of Complete Sets and Parts. Regular shipments daily from leading manufacturers. SPECIAL TERMS TO DEALERS. EXPERT ADVICE FREE. Phone Beekman 1767, Barclay 3346.

48 FULTON ST. (near 3d Ave. L)
34 PARK PLACE (near Woolworth Bldg.) NEW YORK

STOP! LOOK! and ACT!

Type R-3 Radio Magnavox with 14 inch horn, $45.00, premium 1 Ace 22.5 volt Navy size B battery, $2.50 each. Type R-2 Magnavox, with 18 inch horn, $85.00, premium one A. P. or Radiotron amplifier, $6.50 each. Magnavox two stage power amplifier, $8.00, premium one Ace 45 volt, navy size, B battery, $5.00. Magnavox three stage power amplifier, $110.00, premium 1 A. P. Type C power tube, $7.50 each. Twelve hour service or your remittance returned. F. O. B. Abilene. Satisfaction or your goods subject to return within five days.

THE KEHLER RADIO LABORATORIES, Dept. R, ABILENE, KANSAS

The Radio Market News Service

(*Continued from page 54*)

and Omaha, Neb., secure their information directly from the Bureau of Markets and Crop Estimates Offices. The others extending at about 350-mile intervals west from Omaha to the Pacific Coast act as relay stations for the Omaha reports.

Many of the universities and agricultural colleges giving instruction in radio communication in connection with their departments of physics or electrical engineering, have set up programs of broadcasting either alone or in cooperation with the State marketing agencies. This work began with the dissemination of weather reports from the Kansas State Agricultural College in 1916. Crop and market reports are now being broadcasted from several universities and colleges. The number of stations broadcasting the weather, crop and market reports is increasing almost daily. The additions to this list can be secured by addressing the Radio News Service of the Bureau of Markets and Crop Estimates, Washington, D. C.

The map shows the location of the stations now broadcasting. The leased wire connections of the Federal Bureau are also shown. The leased wire service of the Bureau of Markets and Crop Estimates was established in 1916, and during the past six years as many as 17,600 miles of leased wire and 61 branch offices have been in operation. The leased wire has been used to carry reports from the markets, shipment information and reports from shipping points as to supply, demand, and f. o. b. prices. Even in its most extended form, the leased wire with the largest number of branch offices was never able to reach more than a small percentage of the people interested.

The function of the leased wire will not be changed or curtailed by the establishment of the radio method, but will be the nucleus of an effective system employing wired telegraph and telephone as well as radio telegraph and telephone, and may be extended.

The Air Mail Radio Service of the Post Office Department was established primarily to give communication between the flying fields, in connection with the transportation of mail by airplanes. These stations have to be available for service a large part of the day, but have considerable time which is not necessarily occupied in the business of the air-mail service. The market reports are sent out on schedules which are adapted to the unoccupied time at the stations. This incurs merely a nominal additional expense to the Post Office Department, and inasmuch as the market information is obtained for other uses by the Federal Bureau of Markets and Crop Estimates, the service as constituted at present incurs practically no additional expense to this Bureau. Because of the necessity of using stations not intended primarily for broadcast transmission but rather for interstation traffic it is not possible to organize as effective and complete a service as could be furnished by a chain of stations equipped solely for radio broadcast transmission. It is thought desirable, however, to take advantage of every facility available in order to obtain experience in handling market news by this method and be ready to install a more effective service should special facilities be made available at a later date.

FORMS OF REPORTS

Certain types of market information can be put into a form for rapid transmission by use of standard forms and code letters. This does not involve the ordinary use of code words and the necessity of coding and decoding the messages received, but it does make necessary the sending and receiving of

THE NEW RICO TRI-POLE DOUBLE HEAD 'PHONES

PATENTS PENDING

mark a new advance in telephone receivers. These receivers are built on a radically different plan than all other receivers. *The pull on the diaphragm is where it should be*—in the mathematical center of the diaphragm.

RICO receivers "talk for themselves." A trial will convince you. Super-sensitive, especially designed for broadcast work—sounds are brought in sharp and clear. Not a receiver of extraordinary sensitiveness, but an all around receiver whether used for broadcast radiotelephone work, or for long distance radio telegraphy.

OUTSTANDING MECHANICAL FEATURES

Lightness, Stability, Aluminum shells. Non-rusting diaphragms. Guaranteed tungsten magnets. Neat, black mercerized cord. Head band adjustable not only to every size head but *the two bands are adjustable as well;* the only head band made in this manner. Sanitary soft rubber covering that can be washed, will not catch the hair—especially appreciated by ladies.

RESISTANCES: 2,000 and 3,000 ohms. Can be made up to 6,000 ohms if desired.

PRICES { **"Rico" TRI-POLE Head Sets, 2,000 ohms, $6.50**
"Rico" TRI-POLE Head Sets, 3,000 ohms, 7.50

DELIVERY NOW. We have an especially attractive proposition to jobbers and dealers.

Wire or write to

RADIO INDUSTRIES CORPORATION

131 Duane Street New York City

The Whole Family Listens With a Phonoscope. Only $5.00

Head telephones cost from $5.00 to $15.00 for each person, whereas by using the Phonoscope four people can listen at the low price of $5.00.

The Phonoscope does not cause a reduction in signal strength and voice and music alike are reproduced clearly.

RADIO DISTRIBUTING CO NEWARK, N. J.

RADISCO

APPARATUS HEADQUARTERS

Special Parado Offer No. 5

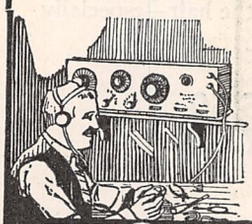
This complete outfit will give you a receiving set with 2-step amplifier with a range of 1,000 miles. It includes Parado Offer No. 1 advertised in the January Radio News, and Parado Offer No. 2 advertised in the March Radio News.

Complete Parado Receiving Set No. 1 **$36.60**
Complete 2-step Amplifier Set No. 2 **31.60**
Entire Outfit, Parado Offer No. 5.... **$68.20**

NOTE—You can order both sets or either at the above prices.

Complete instructions for assembly and connections furnished FREE with order.

Write for other combination offers and FREE BULLETIN P-15



Peoria Radio Sales Co.
Dept. B
PEORIA, Illinois

Special Dealer Plan

Dealers:—Write for our new plan on distribution. We are taking orders on monthly allotment basis. Our dealers and agents get the best lines of equipment. We distribute these lines:

Acme Clapp-Eastham Grebe
Adams-Morgan DeForest Moorhead
Baldwin Jewell Murdock
Brandes Federal Pacent
Westinghouse Radio Corporation

Write today for New Dealers' Discount Schedule No. 8

KLAUS RADIO CO.
Dept. 200
Eureka, Ill.

FIRST TESTED—THEN SOLD

MIRALITE

USE "MIRALITE" FOR RADIO PANELS
A high grade phenol condensite product

Genuine "Spaghetti" Tubing
Impregnating Compounds
"Non-capacity" Coil Varnishes
"Everything in Insulation"

MITCHELL-RAND MFG. CO., 21 Vesey St., New York

the reports on special forms. Inasmuch as the sender and the receiver use identical forms, it is possible by the use of code letters preceding each blank space in which information is to be copied to transmit rapidly a large amount of information prepared in standardized form. By the use of such special forms and regular transmitting schedules a very effective service can be developed. This field has only been touched upon and great improvements undoubtedly will be developed in the handling of information in this way by both radio telephone and radio telegraph.

The receiving of reports by telegraph codes, using dots and dashes, makes it necessary that receiving operators understand the international (continental) code and be able to copy at least 15 words a minute. Wherever radio telephone communication is established, it is necessary only that the operator be able to adjust the radio receiving equipment properly, since the telephone reports are reproduced in the radio receiving equipment just as they would be in a wall or desk telephone. Wherever it is desired to utilize the reports sent by radio telephone, for publication or further distribution, they can be received and copied by a stenographer. At the present time only a few special forms of reports have been developed for use in radio broadcast communication. Others will be developed from time to time as the service grows and modifications of the present forms undoubtedly will be made.

In the forms of reports already in use, two-letter code symbols are used to designate the information sent. These are used in two different ways: (1) A two-letter symbol is placed at the beginning of the blank space, which is to contain a certain type of information. The operator simply sends the two code letters and the information occupying the blank space. For example, in sending "New Jersey sacked Irish Cobbler potatoes per 100 lbs., in consuming markets, New York SR $1.75–2.10," the operator would send only "(SR) $1.75–2.10." (2) Code letters are also used to designate certain options or alternatives to indicate types of information. For example, "Demand for Wheat, Milling, Strong (DK)..... Fair (DL)....., Poor (IM)....." The operator would send (DK), (DL) or (IM), as indicating one of the three alternatives and the receiving operator would put a check mark in the blank space following the letters received. Fractions are avoided wherever possible, but when necessary are sent as follows:

$1.50 is sent as IR50.
$1.50½ is sent as IR50.
$1.50½ is sent as IR50 and 1 DN 2.
⅞ of 1 cent is sent as 7 DN 8 cents.
65⅞ cents is sent as 65 and 7 DN 8 cents.

COOPERATION WITH STATES

In a number of States the State bureaus of markets and State extension departments are cooperating with the Federal Bureau of Markets and Crop Estimates in organizing the agricultural communities to receive and utilize radio crop and market reports. In some cases they have established information centers which serve as distribution points for sending out the information through various channels. In some cases progressive agricultural counties have installed receiving equipment in connection with farmers' organizations so that the information will be available to the county agent for further extension either through the daily newspapers, telephone exchanges, or other agencies. It is probable that an important application of the radio service will be through organizations or institutions which will install equipment with competent operators to receive the reports and distribute them or make them available to individuals or groups or organizations of producers. Since the radiophone is coming into more general use, many of those engaged in producing or marketing farm products are installing equipment to receive the reports directly as no special trained operator is necessary to operate the equipment.

For Your "A" Battery—VESTA Cheapest in the Long Run

Few operators today would hesitate at the expense of the vacuum tube amplification needed to pick up the more distant points

But a vacuum tube outfit requires a storage battery to operate it and the cost of a good storage battery has prevented many operators from enjoying the additional possibilities a bulb set opens up.

Secondhand and rebuilt batteries are a poor investment for this purpose. The first cost may be lower than a good battery, but the frequent recharging necessary and the fact that their current output drops at the time you need it most make them a constant source of annoyance and expense.

A good battery that will hold its charge over a long period is the most economical in the long run. Such an "A" storage battery is now available at moderate cost. It is the new Vesta Radio "A," built in three styles and three sizes.

All Vesta Radio "A" Batteries are of the sturdy Vesta construction which has proved so successful in automobile work. For radio purposes these batteries are built with extra thick plates to give exceptionally long life and to require infrequent recharging. Two to four years' service can be expected from Vesta Radio "A's" if kept watered and recharged when the gravity falls below 1200° —no other attention is necessary.

Vesta Battery Service Stations catering to the automobile trade and Radio dealers are supplying these batteries. Consult your telephone book or write us if you are unable to locate your neighborhood Vesta Station.

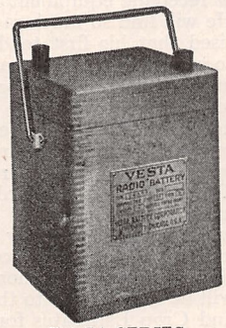
VESTA BATTERY CORPORATION
2100 Indiana Ave., Chicago, Illinois

PRICES

No.	Amp.Hrs.	Prices
6 EA 5	60	$17.50
6 EA 7	80	20.00
6 EA 9	100	23.00
V6 EA 7	80	21.50
V6 EA 9	100	28.00

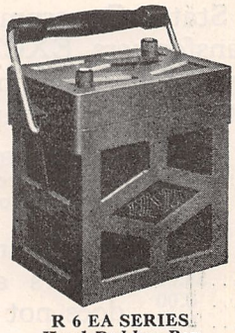
Vesta six-volt Radio Batteries are made in three styles and three sizes.

The ampere draw of a vacuum tube is approximately one ampere.



V 6 EA SERIES
Finished Maple Box

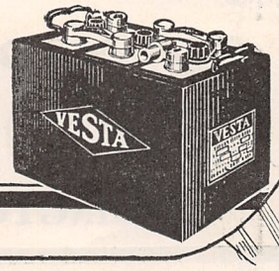
6 EA SERIES
Black Wood Box



R 6 EA SERIES
Hard Rubber Box

VESTA

COSTS LESS PER MONTH OF SERVICE



Springfield Braided Antenna Cable

Gives Stronger Signals

Springfield Braided Antenna Cable is a hollow 16-strand braided cable, about twice the diameter of ordinary cable.

This unusually large conducting surface and consequently low "skin effect" at radio frequency greatly increases your receiving and sending range.

It is light weight, strong and very flexible. Ideal for any type antenna, particularly for portable use by the camper, or for indoor loops. Easily wound, or draped from picture moulding.

As soon as you *see* Springfield Braided Antenna Cable—you will want it.

Retail price, $2.50 per 100 feet, packed in cartons containing 1000 continuous feet, separated 10 coils of 100 feet each.

Sampling Orders, cash to accompany orders, are put up in carton boxes containing 200 feet; no smaller quantities shipped from factory.

Ask your dealer for Springfield Braided Antenna Cable

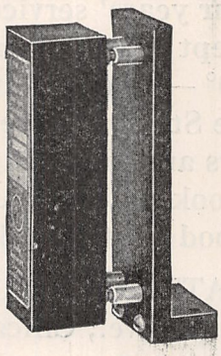
DEALERS AND JOBBERS—write for special introductory offer and prices.

SPRINGFIELD WIRE & TINSEL COMPANY
387a MAIN STREET SPRINGFIELD, MASS.

DX Radio Frequency Amplifying Transformers

Bring in Long Distance RADIO CONCERTS

Standardize—Use The BEST Summer Static
is practically eliminated by using DX RF Transformers with Coil Aerial



United States Government tests prove that DX RF Transformers EXCEL. Extensive tests by Leading Radio Equipment Manufacturers also demonstrate their remarkable value.

Send for FREE BULLETIN No. 12.
RF Amplifier Circuit Diagrams 25c.
Curves and Data on Coil Aerials 50c.

Wavelength Range	Price
170— 450	$8.00
400—1200	8.00
900—3000	8.00
Standard Plug Mounting	1.00

DX Transformers sold through reliable dealers and jobbers. If your dealer does not have them, send us his name.

Higher Range Transformers listed in Bulletin

RADIO INSTRUMENT CO. COMPANY
WASHINGTON, D.C.

The State marketing agencies that have either made installations of equipment or arranged for broadcasting are:

New Jersey Bureau of Markets.....Trenton, N. J.
The Alabama Markets Division.....Montgomery, Ala.
Iowa Agricultural Extension Service, Iowa State College.....Ames, Iowa
Minnesota Division of Markets.....St. Paul, Minn.
Missouri State Marketing Bureau.....Jefferson City, Mo.
Nebraska Bureau of Markets and Marketing....Lincoln, Neb.
New York State Division Foods and Markets...Albany, N. Y.
Ohio Division of Markets.Columbus, Ohio
Pennsylvania Bureau of Markets.....Harrisburg, Pa.
Texas Division of Markets and Warehouse Dept..Austin, Tex.
Texas Bureau of Markets, Dept. of Agri.....Austin, Tex.
Wisconsin Department of Markets.....Madison, Wis.
Massachusetts Division of Markets.....Boston, Mass.
Colorado Division of Marketing and College of Agriculture Cooperating Ft. Collins, Col.

Arrangements in other States are under consideration.

THE TRANSMITTING STATION

Wave Length. There are many technical problems in connection with radio telegraphy and telephony that have to be considered in the dissemination of broadcast reports. The question of wave-length and kind of transmission are both very important.

Most people who have become interested in radio have bought short-wave receiving sets whether they are amateurs and interested in the technique or are interested only in the entertainment and reports.

For transmission amateurs have been restricted to wave-lengths below 200 meters and in all probability they will be restricted to short wave-lengths not to exceed 300 meters. Wave-lengths for broadcasting public and Department of Agriculture services are located at 360 and 485 meters, wave length respectively. There are 36 stations now broadcasting. Some of these stations have licenses only for use of 485 meters while others have also license to use 360 meters for general broadcasting of news and entertainment.

THE RADIO RECEIVING SET

Type of Receiving Set. It is difficult for the non-technical person to choose the best type of receiving equipment for his specific needs. He will find so much radio equipment advertised that his first tendency will be to turn to some one for information. Some Government Bureau is the logical place to inquire for unbiased opinions. The Bureau of Markets and Crop Estimates has asked the Bureau of Standards to furnish the technical information on radio receiving equipment. The Bureau of Standards has been gathering information regarding radio-receiving sets which are commercially available and is making certain performance tests on many of them. The information gained in this way will be turned over to the Bureau of Markets and Crop Estimates for general distribution and to assist them in answering inquiries from those who wish to avail themselves of the broadcast news. There will probably be a limited number of types of sets needed to meet the general requirements.

Radio-receiving sets are of two general classes: (1) those suitable for receiving signals from sets which transmit damped waves, modulated waves or radio telephone; and (2) those suitable for receiving signals from the above types of sets and also from stations which transmit unmodulated or continuous waves. Damped waves are emitted by spark transmitting sets. The stations broadcasting

THE AMERICAN SPECIALTY MFG. COMPANY, BRIDGEPORT, CONN.

"REGAL" RECEIVING SET

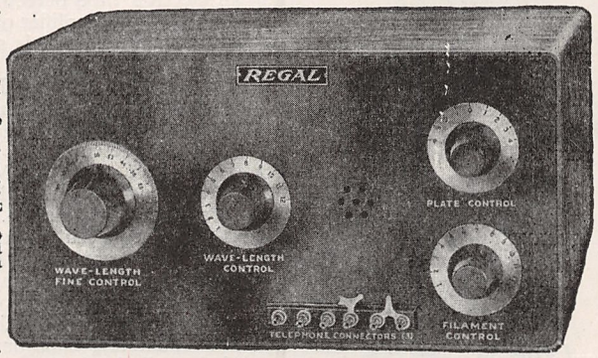
"LISTEN IN" to the world's news and music with a "REGAL"

Like all "REGAL" products, this receiving set has been designed by our own radio engineers and is a scientific product, representing QUALITY—COMPACTNESS—SIMPLICITY, with mechanical and electrical construction of the highest grade in materials, design and workmanship.

The "REGAL" has a wave length range from 150 to 1800 meters, guaranteed, thus enabling the operator to "tune in" on government and broadcasting stations.

NOTE THE EXCELLENT FEATURES OF THE "REGAL"

(1) The minimum number of controls, all clearly marked, with taper knobs and etched silver dials.
(2) The unique "REGAL" telephone connector, allowing use of three pairs of telephones (doing away with all plugs and jacks).
(3) The potentiometer plate control—so necessary to efficient tuning of the modern vacuum tube detector.
(4) The new "REGAL" inductance switch, insuring good electrical connections.
(5) "REGAL" Condenser.
(6) "REGAL" Rheostat.
(7) Mahogany finish cabinet.
(8) High-grade dielectric panel—satin finish.
(9) The rear panel connector for antenna, ground, batteries, etc., doing away with unsightly wires in front of cabinet.
(10) Every part of the "REGAL" designed and built in our own factory.

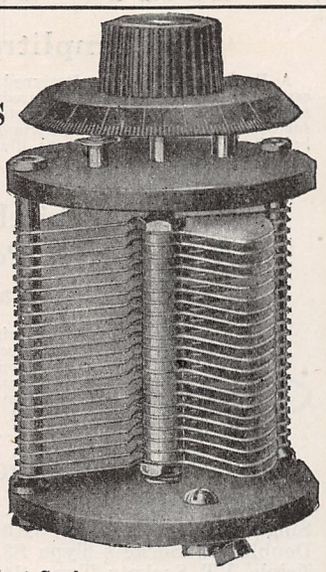


Price $40.00

"REGAL" Junior

Receiving 25 to 40 miles.
Price $20.00

"REGAL" VARIABLE CONDENSERS



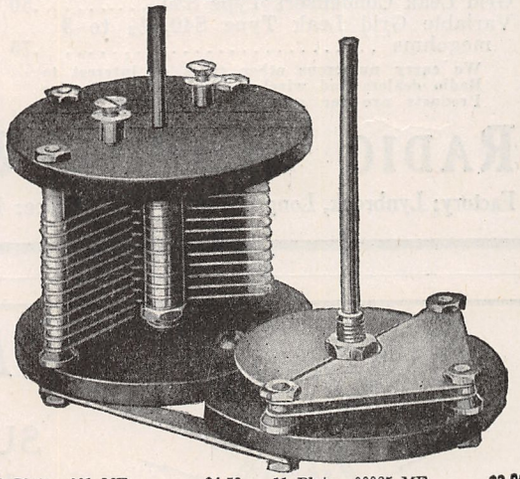
Precision Instruments on which we stake our reputation. Our Condensers are not merely an assembly of miscellaneous pieces of metal and other parts, but are fine quality electrical instruments, suitable for laboratory use.

NOTE THIS CONSTRUCTION

Plates—1/32" thick, hard pure aluminum.
End Plates—of high grade dielectric.
Positive tension adjustment.
Shaft runs in machined bearings.
Accurately machined and inspected spacers.
High ratio of maximum and minimum capacity.

Correct Design plus Highest Grade Workmanship plus Finest Materials Equals "Regal" Condensers

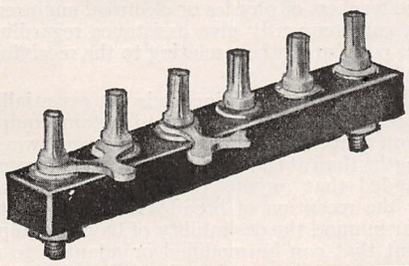
23 Plate with Vernier.



43 Plate, .001 MF.....$4.50
23 Plate, .0005 MF.....3.50
11 Plate, .00025 MF.....$3.00
3 Plate with Vernier.....2.50
With Dials Extra.....$1.00

EVERY "REGAL" CONDENSER GUARANTEED.

"REGAL" TELEPHONE CONNECTOR



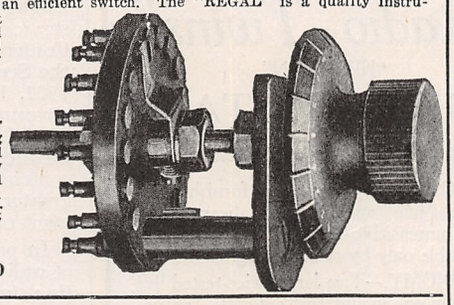
DOES AWAY WITH ALL TELEPHONE JACKS AND PLUGS—This is an ingenious "REGAL" unit, consisting of six (6) spring cord tip sockets, with two connecting switches, permitting one, two or three telephones to be brought in as desired. Compact and attractive. Ready for mounting on panel or can be used unmounted as series connector for extra telephones from amplifier, etc.

Connect with a "Regal." Price, $1.50

Patent pending.

"REGAL" INDUCTANCE SWITCH AND DIAL

One of the essentials of a good receiving set is an efficient switch. The "REGAL" is a quality instrument with advantages readily appreciated. It has a smooth wiping contact over heads finished to same height, quite different from the usual grooving lever "bumping over a series of knobby points."



OTHER UNIQUE AND STRONG FEATURES

One piece contact points with grooved ends for a turn of the wire and touch of solder—doing away with the usual unsightly job when threaded metal points and nuts are used. Permits easy assembling with coil, then mounting on panel with the drilling of but one hole in the panel. The numbered dial with knob, enabling operator to readily locate points at which to "tune in" for the wave length desired.

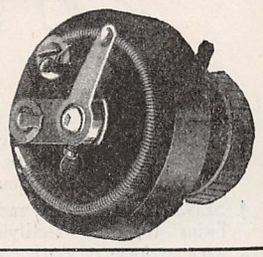
Switch to a "Regal"

Price $2.00

Patent pending.

"REGAL" RHEOSTAT

A vacuum tube is no more sensitive than its control. The "Regal" Rheostat is mechanically perfect. It gives the critical adjustment so necessary to the efficient operation of a vacuum tube. It has a smooth working control. It is built of high grade resistance wire, has heat resistance base, handsome knob and highly nickel-plated parts.



5 Ohms—1¼ Amperes.

WE STAND RIGHT BACK of every "REGAL" RHEOSTAT

Price $1.25

"REGAL" PRODUCTS

Antenna Wire

No. 14 Hard Drawn Copper, per lb	$0.40
500 feet	2.15
Seven (7) Strand No. 22 Tinned Copper, per foot	.01
500 feet	4.00
Copperweld. 100 ft. coil	.75
150 ft. coil	.90
200 ft. coil	1.00

Binding Posts. Brass Pol. Nickel

No. 22 Washer and 6-32 screw—Barrel and Knob fine finish, each	.12
Dozen lots	1.25
No. 24 Smaller size Barrel and Knob, 9/16" long, fine finished, each	.09
Dozen lots	1.00
No. 26 Large size with composition Knob, each	.09
Dozen lots	1.00
No. 28 Large size with hole for phone tip or wire, each	.12
Dozen lots	1.25
No. 30 Small size with hole for phone tip or wire, each	.12
Dozen lots	1.25

Dials, with Knobs, Hard Rubber

3 inch	1.00
4 inch	1.50

"REGAL" IMPROVED VARIOMETER, $4.50. (With Dials, $1.00 extra.)

Horns

"ARKAY" Loud Speaker, Nickel or Bronze	$6.00
Phonograph Attachment	1.50

Switch Arms and Points

No. 64 Switch Arm, Knob 1", Lever 1½"	.45
No. 65 Switch Arm, Knob 1¼", Lever 1½"	.50
No. 67 Contact Point, 3/16x⅛"	.03
No. 68 Contact Point, ¼x¼"	.04
No. 69 Contact Point, ¼x⅛"	.04
No. 72 Switch Stops	.05

Telephone Head Sets

"AMERICAN" Navy Type, 2500 Ohm	10.00
"AMERICAN" Navy Type, 3200 Ohm	12.00
"FEDERAL" 53-W, 2200 Ohm	6.75
"FEDERAL" 52-W, 3200 Ohm	9.00

(Complete with Cords and Bands.)

Telephone Jacks—Radio Type

"REGAL" No. 82 Open Jack	.70
"REGAL" No. 83 Closed Jack	.85
"REGAL" No. 84 2-Circuit	1.00
"REGAL" No. 85 3-Spring, F. C.	1.20
"REGAL" No. 86 5-Spring, F. C.	1.50

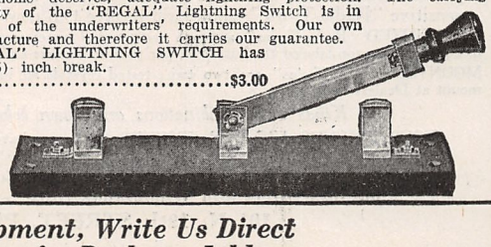
Tube Sockets

"REGAL," moulded of high heat-resisting material in one single piece, highly polished	1.00

"REGAL" IMPROVED VARIOCOUPLER, 4.00

"REGAL" LIGHTNING SWITCH

A WORD OF WARNING—Protect your home with something you can absolutely place dependence upon. The underwriters demand, and your home deserves, adequate lightning protection. The carrying capacity of the "REGAL" Lightning Switch is in excess of the underwriters' requirements. Our own manufacture and therefore it carries our guarantee. "REGAL" LIGHTNING SWITCH has five (5) inch break.



Price $3.00

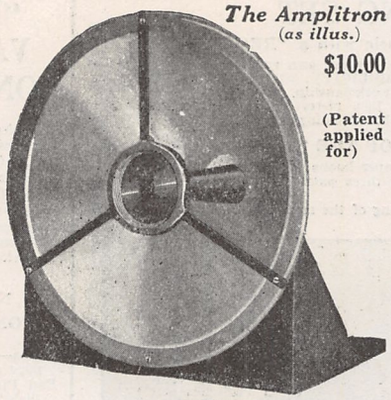
If Your Dealer Does Not Carry "Regal" Radio Equipment, Write Us Direct
Watch This Page for New Ideas Attractive Proposition for Dealers—Jobbers
Send for our handsome new Radio Supply Catalog No. 20

THE AMERICAN SPECIALTY MFG. COMPANY General Offices, 145-165 Holland Ave. Factories, Holland Ave. and Ash St. **BRIDGEPORT, CONN.**

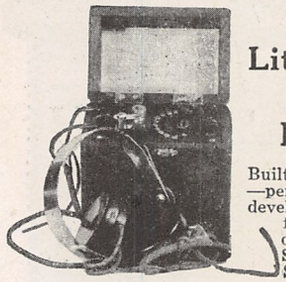
RADIO SERVICE PRODUCTS

The Amplitron

A Real Loud Speaker—Designed and constructed especially for radio work. Reproduces radio phone speech and music without distortion—equally good for code. For use with a Baldwin Type C or Stromberg-Carlson Phone. Price (as illustrated)...$10.00



The Amplitron (as illus.) **$10.00** (Patent applied for)



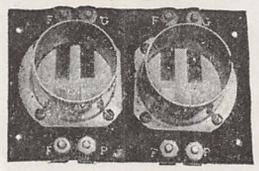
The Little Wonder Portable Radio Set

Built right and compact—perfected by four years' development and manufacture. Simple to operate. Receiving Set Only, Type S8.....$7.50

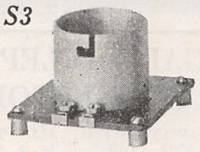
Other Radio Service Products

Single VT Sockets Type S2	$1.50
Single VT Sockets Type S10	1.00
Double VT Sockets Type S3	2.25
Triple VT Sockets Type S4	3.25
Grid Condensers .0005 mf. Type S15	.35
Phone Condensers .002 mf. Type S16	.35
Grid Leak Condensers Type S30	.50
Variable Grid Leak Type S40, ½ to 3 megohms	.75

We carry numerous other types of interest to Radio dealers and wireless men. Radio Service Products are for sale by all reliable dealers.



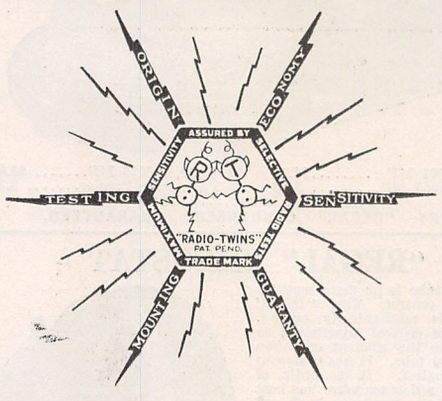
Type S3



Type S10

RADIO SERVICE & MFG. CO.

Factory: Lynbrook, Long Island **Sales Office: 110 West 40th St., New York City**



"Radio-Twins"

"HEXAGON"

SUPER-CRYSTALS

Have Six Points of Superiority

1. ORIGIN.—Very few mines furnish sensitive or "live" mineral. It is always mixed with unsensitive or "dead" ore, and is separable only by radio testing.
2. ECONOMY.—Two large twice-tested live twins in one mount cost only 50c., or unmounted 35c., whereas you pay for two single unmounted crystals 50c., usually dead ones at that.
3. TESTING.—Each super-crystal is tested in our Radio Laboratories by our licensed operator for clear signals on at least six points. Each one in the mounted "Radio-Twins" is tested before and after mounting, making four tests in all.
4. SENSITIVITY.—Any radioist knows that, of 6 crystals bought, 5 are worthless. In the "Radio-Twins" the intense rectifying area is twice that of the best of the old single mounts.
5. MOUNTING (PATENT PENDING).—Instead of a desensitizing cheap and soft solder, we make our own costly and hard "Radalloy." The "Radio-Twins" present the most sensitive faces of two super-crystals in opposite heads of the 15/32″ metal cylinder.
6. GUARANTY.—We guarantee 200% sensitivity in every 100 mounts. Anyone returning one insensitive "Radio-Twins" mount will receive two new ones instead.

UNMOUNTED "Radio-Twins" are each radio-tested once; wrapped in tinfoil and packed together in one neat, dirt-proof, Hexagon-labeled tin box. 35c. per pair at Dealers Only.

MOUNTED "Radio-Twins" are two twice-tested crystals set in opposite ends of one "Radalloy" mount. 50c. per mount at Dealers Only.

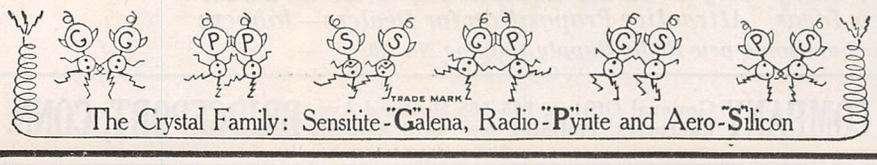
Kinds and Combinations are shown below by the "Crystal Family"

YOUR FRIENDS ARE OUR FRIENDS—after you have listened to the "Radio-Twins" clear speech

FOOTE MINERAL COMPANY

Manufacturers and Wholesalers Only - Established Forty-six Years

101 N. 19th STREET, PHILADELPHIA



The Crystal Family: Sensitite-"G"alena, Radio-"P"yrite and Aero-"S"ilicon

by radiophone are increasing in number and it may be expected that in a very short time all sections of the country will have services provided. The Air Mail Radio Stations which are continuing to broadcast crop and market information by radio telegraph use continuous wave types of transmitters and send on wave lengths of from 2,500 to 4,000 meters.

A receiving set of the first class referred to may be a very simple set equipped with a crystal detector. However, such a set is relatively insensitive and can be used for receiving only over short distances. Most receiving sets of the second type referred to use an electron tube detector, to which may be connected an amplifier of one or more stages. The crystal detector is suitable for receiving radio telephone signals at points near the transmitting station. In certain localities near radiophone sets which are broadcasting the market reports, it may be possible to use the crystal detector sets, but the broadcasting by the Post Office Air Mail Stations is done on the long waves by the use of continuous wave radio transmission. This does not necessarily mean that anyone will have to discard his present sets if he wishes to get the market news. The majority of these sets can be easily adapted to receive messages at the longer waves by such means as the addition of loading coils or by rewinding some of the coils in the sets. High school or college teachers of physics or electrical engineering can frequently give assistance regarding this point and others relating to the receiving equipment.

If one plans in advance it is not essentially more difficult or expensive to obtain equipment that will receive at the longer wave lengths than at the shorter ones. It is recommended that anyone purchasing equipment for the reception of broadcast radio reports bear in mind the desirability of having equipment that can be modified or adapted to a wide range of wave lengths. In the determination of a consistent policy relating to broadcasting, many matters, such as wave length allocation for the different type of services will have to be made. The Radio Conference called under executive order by the Secretary of Commerce on February 27, 1922, brought together a representation of government, State and private interests concerned in the development and use of radio broadcasting. Recommendations from this conference will probably result in laws giving greater regulatory authority to the Department of Commerce.

In purchasing apparatus for the reception of radio market news from a given transmitting station the wave-length range desired to cover, name of and the distance from the transmitting station should be considered.

Cost of Receiving Sets. Any attempt to give the cost of commercial radio-receiving sets is attended with difficulties. Some sets may be designed in which dependability is the sole criterion, while others may embody fine appearance with dependability. The showy, unreliable sets are not to be considered here no matter what the cost, for service is of prime importance.

Reliable radio-receiving equipment, such as is now on the market or which may be especially built for market news reception, will probably cost between $75 and $150. These prices cover the range of sets from a simple electron-tube detector set to the more complex receiving set complete with detector and three-stage amplifier panels, storage battery, dry batteries, telephone receiver, electron tubes, and possibly some simple antenna equipment. A crystal detector receiving set, suitable for receiving radio telephone messages from comparatively near by transmitting stations, is advertised for $10.00 and higher, depending on the accessory equipment included with the set.

The Bureau of Standards expects soon to be in a position to give information on the cost of receiving apparatus and names of

A superior insulation having every desirable characteristic in radio-frequency.

"RADION" New Process Warp-Resisting PANELS

WE developed "RADION" in our laboratories as an all-purpose insulation, whose properties make it supreme in the Radio field. Thousands of "RADION" panel sheets are being sold by Dealers daily because men who build Radio sets have learned that—

1. "RADION" resists warping.
2. "RADION" resists enormous voltage in high frequency currents.
3. "RADION" does not chip and is easy to cut, drill, tap, thread, stamp and engrave.
4. "RADION" comes in stock panel sizes 3/16 and ¼ in. thick, 10 x 12 in., 8 x 15 in., and 20 x 24 in. Three colors—Black, Brown and the new Mahoganite (beautiful mahogany grain).

"RADION" New Process Hard Rubber RADIO PARTS

"RADION" Dials

Standard 3 in. and 4 in. diameter with set screws 3/16 or ¼ in. shaft hole. Knob and Dial moulded in one piece.

"RADION" Socket Bases

A "RADION" Hard Rubber Socket Base of approved design for standard makes of Detector and Amplifier Tubes.

"RADION" Aerial Insulators

Strongly imbedded metal rings. Perfect out-door insulations for antennae wire work.

"RADION" Tubing

for Variometers, 2 and 4 in. outside diameter. ⅛ in. wall, unpolished standard 2 foot lengths in stock.

"RADION" Hard Rubber Rods, Discs, Slider Blocks, Knobs, etc.

DEALERS—*Our National Advertising is making thousands of Radio fans ask for RADION Panels and Parts. Don't delay. Write your jobber to-day for information and prices.*

MANUFACTURERS—*Our three great factories are equipped for special moulding of radio parts in large quantities in "RADION" Hard Rubber, such as Radio Cabinets, Ear Caps, Receiver Cases, Y-pieces, Storage Battery Jars and Parts, Knobs, Buttons, Bushings, Ferrules. "RADION" Panels cut to any size on quantity orders. Let us estimate on your specifications.*

JOBBERS—*We are receiving hundreds of dealer inquiries every week from our National Advertising—many from your own territory—and referring them to Jobbers handling RADION Panels and Parts. Write at once for our jobbing proposition and get the benefits of this National Advertising.*

RADIO SALES DIVISION

AMERICAN HARD RUBBER COMPANY

11 Mercer Street -:- New York

U.S. RADIO Co.
OF PENNSYLVANIA INC.

Insist on Getting

U. S. EAGLE GALENA, 25 Cents
U. S. EAGLE GOLDENA, 35 Cents

MOUNTED U. S. EAGLE GALENA or GOLDENA, 2-in-1, 50 Cents

Patent Applied

Marvelous Crystals of sensitivity; Improve your Radio Reception by the use of these Crystals. No better on the American Market. Each Crystal is packed in a container and labeled U. S. Eagle Galena or U. S. Eagle Goldena.

Attractive proposition for dealers and jobbers. Immediate shipment. Will use your own labels on request. Also in bulk.

EVERYTHING IN RADIO SUPPLIES SEND FOR CATALOGUE

U. S. RADIO CO. of PENNA., Inc.
Distributors and Manufacturers of Radio Apparatus

Corner of Ferry and Diamond Streets
Pittsburgh, Pa., U. S. A.

Ready for Delivery

All Sets and Parts of the following Manufacturers

Radio Corp.
Westinghouse
W. T. Murdock
Fada
Chelsea
Baldwin meters
VARIO couplers

Paragon
Pacent
Western Electric
Acme
Electrose
Hergo "B" Batteries
Copperclad Wire

And many others

PHONES and TUBES

Up-to-date Call Book Mailed on Receipt of $1.00

Telephone Rhinelander 5825 - 5660

DEALERS Write Dept. W

H. Goldberg (Est'd 1894)
1373 Third Ave., Bet. 78th & 79th Sts.
NEW YORK, N. Y.

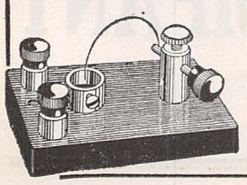
RADIO DETECTORS

Size 3¼ x 2"

An improved detector of real merit. Nickel-plated posts.

Price 75 cents, post paid

Dealers get our prices on Panel Switches and Binding Posts.



SYPHER MFG. CO.
Dept. R., TOLEDO, OHIO

Large Variometers, inside windings.....$5.00
Rheostats, with engraved dials and knobs, $1.40; with tapered knob only, $1.00. Small engraved knob and dial, 50c. Variometers, hard maple forms, $5.00. Variocouplers, wound on Formica tubes, $5.00.

OAK CABINETS

6"x14"x7" deep with hinged tops, and reinforced..$3.25
7"x 7"x7" deep with hinged tops, and reinforced..$2.25
7"x10"x7" deep with hinged tops, and reinforced..$3.00
7"x12"x7" deep with hinged tops, and reinforced..$3.25
7"x18"x7" deep with hinged tops, and reinforced..$4.25
12"x14"x7" deep with hinged tops, and reinforced..$4.50

Dealers, Write for Proposition.
MEADE BAKELITE AND RADIO APPARATUS
27 Howard Ave. Brooklyn, N. Y.

manufacturers from which it can be purchased. There is in preparation a list of manufacturers of radio-receiving equipment. A partial list of manufacturers of radio-receiving equipment has been prepared. This list is now being revised. This list includes manufacturers of built-up receiving sets as well as separate radio parts with which one can assemble a receiving set.

Laws and Regulations. The laws of the United States require that every radio station used for transmitting signals must have a station license. These licenses are issued by the Bureau of Navigation of the Department of Commerce, Washington, D. C. The United States is divided into nine radio districts. Each district has a Radio Inspector, whose address is given below. (See also Map Opposite.)

1st District, Radio Inspector, Customs House, Boston, Mass.

2d District, Radio Inspector, Customs House, New York, N. Y.

3d District, Radio Inspector, Customs House, Baltimore, Md.

4th District, Radio Inspector, Customs House, Baltimore, Md.

5th District, Radio Inspector, Customs House, New Orleans, La.

6th District, Radio Inspector, Customs House, San Francisco, Cal.

7th District, Radio Inspector, 2301 L. C. Smith Bldg., Seattle, Wash.

8th District, Radio Inspector, Federal Bldg., Detroit, Mich.

9th District, Radio Inspector, Federal Bldg., Chicago, Ill.

Requests for application forms for licenses, or for information concerning licenses, should be addressed to the Radio Inspector of the district in which the station is located; or if this is not known, to the Bureau of Navigation, Department of Commerce, Washington, D. C. A station which is used for receiving only, and does no transmitting, does not require a station license. The operator of a station used for transmitting purposes must have an operator's license, in addition to the license required for the station.

REGULATIONS PERTAINING TO THE RADIO BROADCASTING OF WEATHER, CROP AND MARKET INFORMATION

1. Forecasts, warnings, and weather reports issued by the Weather Bureau and crop and market reports issued or approved by the Bureau of Markets and Crop Estimates shall be broadcasted only from radio stations authorized and licensed to do so by the Bureau of Navigation, Department of Commerce.

2. Broadcasting of weather forecasts and information and crop and market reports shall be confined to radio stations properly equipped for the work and operated by persons holding a commercial second-class or a higher grade of license.

3. No plant will be licensed by the Bureau of Navigation to disseminate weather forecasts and information or crop and market reports, except on the approval of the Chief of the Weather Bureau and of the Chief of the Bureau of Markets and Crop Estimates respectively.

4. The call letter and location of the station and the official authenticity of the information shall be announced preliminary to each broadcast, and is approximately as follows:

This is.....located.....,

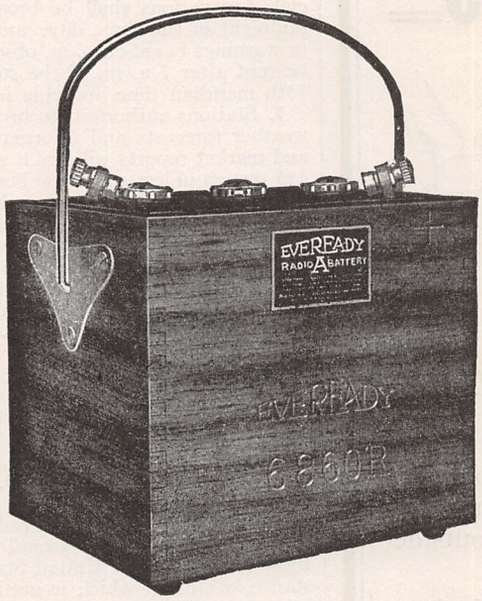
The weather forecast and reports issued by the U. S. Weather Bureau are as follows:

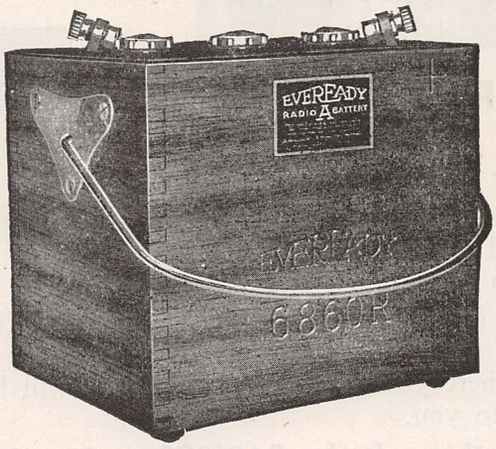
5. The laws pertaining to the issuance of weather forecasts shall be observed. Violators of the following law will be prosecuted:

Sec. 61. Whoever shall knowingly issue or publish any counterfeit weather forecast or warning of weather conditions falsely representing such forecast or warning to have been issued or published by the Weather Bureau, United States Signal Service, or other branch of the Government service, shall be fined not more than five hundred dollars, or imprisoned not more than ninety days, or both. (Act of March 4, 1909, C 321, 35 Stat., 1088.)

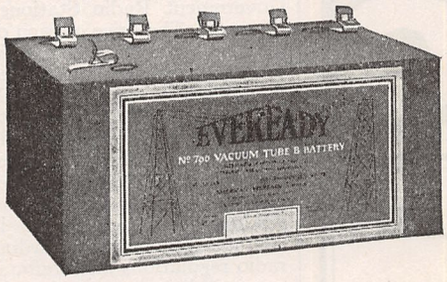
6. All broadcasts shall be according to

Eveready "A" Batteries
—hardwood box, mahogany finish
—convenient handle, nickel plated
—rubber feet protect the table
—insulated top prevents short circuits
—packed vent caps prevent spilling
No. 6860— 90 Amp. Hrs.—45 Lbs.—$18.00
No. 6880—110 Amp. Hrs.—52 Lbs.—$20.00





Eveready "B" Battery No. 766
Equipped with 5 positive voltage taps ranging from 16½ to 22½ volts. Fahnestock Spring Clip Binding Posts—an exclusive Eveready feature. Price $3.00



Eveready "B" Battery No. 774
Equipped with 6 positive voltage taps at 4½ volt intervals ranging from 18 to 43 volts. Fahnestock Spring Clip Binding Posts—an exclusive Eveready feature. Price $5.00

For Better Results

USE

EVEREADY

"A" and "B" BATTERIES

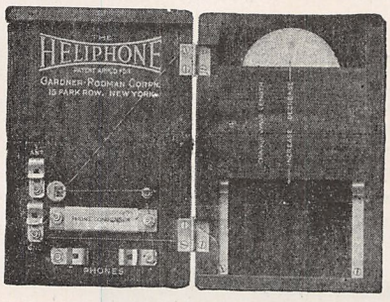
with your radio set

For sale by the better radio supply dealers everywhere

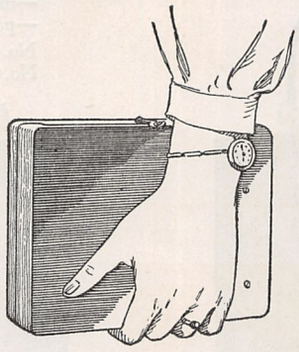
Send today for descriptive booklets

NATIONAL CARBON COMPANY, Inc., Long Island City, N. Y.

Atlanta Chicago Cleveland Kansas City San Francisco



POCKET RECEIVER $5.00



Compact Well Made Efficient

THE HELIPHONE is one of the most remarkable receivers developed in late years. It is complete in every detail—permits sharp tuning.

This is just the instrument for your vacation—can be used aboard train, steamboat, while camping or fishing—in fact, everywhere you go the HELIPHONE will bring the outside world to you.

Order this and other RADISCO products from your dealer

RADIO DISTRIBUTING COMPANY

"If It's Radio—We Have It"

NEWARK, NEW JERSEY

RADISCO

Keep Up to the Minute On Radio!

Read the three interesting and instructive books by James R. Cameron, whose text books are used and endorsed by the U. S. Army, Navy and Dept. of Public Instruction.

How to Build Your Own Radio Set

Full instructions with diagrams and drawings which make it easy for beginner to build his own set. **25 cents.**

Radio Dictionary

Words and terms relative to Radio parts and equipment clearly defined—with tables and information. **50 cents.**

Radio for Beginners

A book that deals with the subject from A to Z, written so that the amateur can understand it. **$1.00**

Buy Them from Your Dealer Today or Direct from

TECHNICAL BOOK CO.

130 West 42nd St., New York

Dept. B

¼ in. Sliders—Brass, 20c; Nickel, 25c
¼ in. Slider Rods—Brass, 15c; Nickel, 20c
Crystal Detectors, Nickel Plated on Mahogany Base, $1.00
Double, Nickel Slider Tuning Coils, $3.00
Contact Points, threaded with nuts, 20c dozen
Compo. Cap, Nickel Base Binding Posts, 7c each
Plain Nickel Binding Posts, 3½c each
Liberal Discounts to Dealers
F. JOS. LAMB COMPANY
1960 FRANKLIN ST. DETROIT, MICHIGAN

CUT PRICES

Radio Service V. T. Sockets	$0.80
No. 14 Solid Copper Aerial Wire, pound	.40
Seven-strand Copper Aerial Wire, 100 feet	.85
Cyclone Small "B" Batteries, 22½-volt	.90
.002 M. F. Phone Condensers	.25
.0005 M. F. Grid Condensers	.25
Titan Storage Batteries, 6-volt	14.00

KENSINGTON RADIO SUPPLY CO.
4416 18th Ave. Brooklyn, N. Y.

schedules approved by the Weather Bureau or by the Bureau of Markets and Crop Estimates. No forecasts based on a. m. observavations shall be broadcast after 7 p. m. of the same day; no special warnings based on special observations shall be broadcasted after midnight of the same day; and no forecasts or warnings based on p. m. observations shall be sent after 7 a. m. of the succeeding day, 75th meridian time applying in all cases.

7. Stations authorized to broadcast official weather forecasts and information and crop and market reports will use a wave-length of 485 meters unless otherwise licensed to do so by the Bureau of Navigation, Department of Commerce. This special wave-length shall be used for no other purpose.

8. License to broadcast weather forecasts and information and crop and market reports shall be revocable at any time that it may be in the public interest to do so.

Every person engaged in any form of radio communication should have a copy of a pamphlet, "Radio Communication Laws of the United States," which can be secured by sending fifteen cents (not in stamps) to the Superintendent of Documents, Government Printing Office, Washington, D. C.

Canadian Radio Laws. The laws regulating the operation of private radio stations in Canada are different in several respects from those in force in the United States. For instance, a station which is used only for receiving must have a station license. For authoritative information, inquiry should be made to the Deputy Minister of the Naval Service, Ottawa, Ontario.

List of Radio Calls. Every owner of a radio-receiving set should have a copy each of the pamphlets, "Amateur Radio Stations of the United States," and "Commercial and Government Radio Stations of the United States." The price of each of the pamphlets is fifteen cents, and orders should be sent to the Superintendent of Documents. These pamphlets contain lists of the amateur and commercial and Government stations in the United States, and of the call letters assigned to the stations. A new edition of each pamphlet is published on June 30th of each year. A monthly publication called the "Radio Service Bulletin" is issued which contains information regarding changes in the radio regulations and traffic information and notes, additions to or other changes in the list of "Commercial and Government Radio Stations." Copies of the "Radio Service Bulletin" may be secured from the Superintendent of Documents for five cents per each issue, or subscriptions may be ordered for 25 cents per year.

A "Consolidated Radio Call Book" is published by the Consolidated Radio Call Book Co., 98 Park Place, New York, N. Y. This gives the calls of both United States and foreign stations.

A list of commercial and government stations operating in the United States and in foreign countries is given in the "Year Book of Wireless Telegraphy," mentioned above.

The following is a list of the air mail stations now licensed to broadcast Weather, Crop and Market Reports.

For complete schedules and for the additions to this list which are being made from time to time address: Radio News Service, Bureau of Markets and Crop Estimates, U. S. Department of Agriculture, Washington, D. C.

Washington, D. C.	WWX
Radio Telephone	1,160
Radio Telegraph Tube C. W.	1,980
Omaha, Neb.	KDEF
Radio Telegraph, Arc Undamped	2,500
North Platte, Neb.	KDHM
Radio Telegraph, Arc Undamped	4,000
Rock Springs, Wyo.	KDHN
Radio Telegraph, Arc Undamped	3,000

Read the classified ads on pages 204, 205 and 206.

AMRAD

The Recognized Symbol of Superior Performance

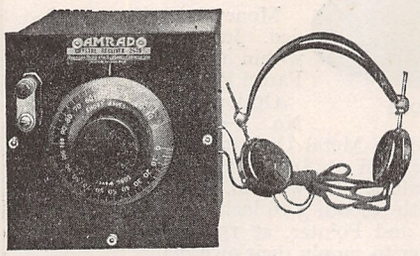
Your First Set

Will bring you greater satisfaction if it is chosen deliberately. If you live near a broadcasting station and wish to spend only a moderate amount on your equipment a receiving set of the crystal type is the ideal purchase.

Close observation will reveal wide differences in the quality of crystal receivers. While it is true, generally speaking, that no set is better than its crystal, there are certain refinements in some types of receivers which the user rarely appreciates until after the first thrills of radio reception have worn off.

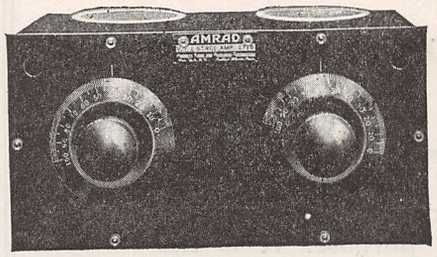
In the Amrad Crystal Receiver one finds a unique combination of exclusive features. It covers a wide wavelength range, continuously—not in jumps—by the rotation of a single dial. No shifting of wires from one binding post to another. Encased in a solid mahogany cabinet, highly polished, it never fails to please the eye. Connecting wires terminate at the rear. Materials of the best quality prevail throughout; you can see, months later, that the money value is there.

And best of all the Amrad Crystal Receiver is expressly designed to operate with other receiving elements which may be added whenever you please.



AMRAD CRYSTAL RECEIVING SET $28.75
A Beginner's Set De Luxe—One You Never Need Discard, Anyone Can Operate. Price includes Phones and 125 ft. aerial wire. Range 15-25 miles.

AMRAD COMBINATION B-1
Range for Radio telephone, 50 miles.
Range for Radio telegraph, 500 miles.
Amrad Crystal Receiver, 2575 ..... $23.00
VT Detector only, 2771 ..... 16.50
AMRAD Load Coil only, 2962 ..... 4.50
(The above is one of 15 Combinations)



AMRAD VT 2 Stage Amplifier, 2776 ..... $42.50
Can be added to either of above Sets to triple range and audibility. (All units described in Bulletin F.)

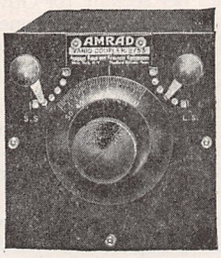
Pay As You Progress

To the Amrad Crystal Receiver may be added VT Detector, VT Amplifier, or other receiving units. Receiving range and audibility are increased as you expand your equipment until finally your outfit rivals the performance of the best vacuum tube sets of elaborate construction.

Adherents of the Amrad Unit System literally feel their own way into space. Each unit added calls for slightly more skill in making adjustments. Few operators get the maximum possible response from the larger sets, but the Amrad method trains the user in a series of easy steps until expert operating technique is achieved.

Amrad Unit Combinations are not only practical from a radio standpoint. Mechanically they equal ready-built sets. The simple application of special connectors makes of even the most elaborate combinations a rigid composite.

In spite of market conditions the Amrad Crystal Receiver is not difficult to obtain. Special announcements featuring this instrument have been postponed purposely until such time as we are able to supply all of our distributors **from stock.** If your local dealer does not have the Amrad Crystal Receiver **he can** get it for you. Descriptive Bulletin M mailed free on request. Complete Amrad Catalog describing over 100 articles, 10 cents, stamps.



No. 2753
Vario-Coupler
$20.00

No. 2752
Variometer
$13.00

No. 2777
Variable Condenser
$10.00

No. 2771
VT Detector
$16.50

No. 2766
VT 1-Stage Amplifier
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New York District Office
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General Office, Factory and Laboratory
203 College Avenue, Medford Hillside, Mass.

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600 So. Dearborn St.

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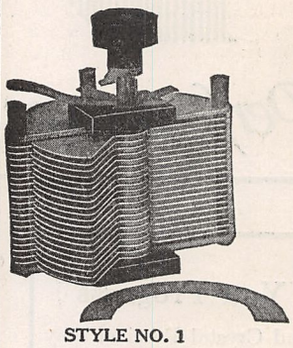
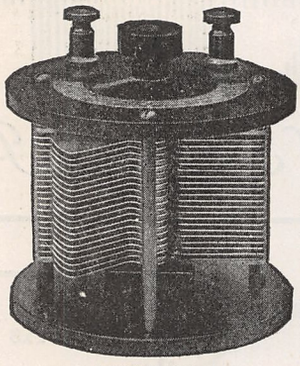


STYLE NO. 1



STYLE NO. 2

Three Styles: No. 1, Panel; No. 2, Open Type as shown; No. 3, Fully Encased. Anti Profiteer. Less than pre-war prices. Fully assembled and tested.

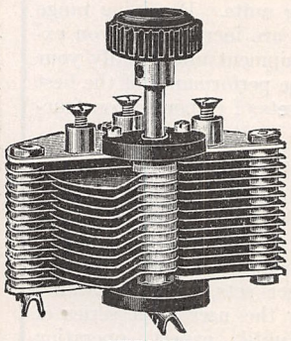
Style	No. 1	No. 2	No. 3
67 Plates,	$7.00	$8.00	$8.50
43 "	3.50	4.50	4.75
23 "	2.75	3.75	4.00
13 "	2.25	3.25	3.50

Money back if not satisfied. Just return condenser within 10 days by insured Parcel Post.

Options: — With Style No. 1—instead of Scale and Pointer, a 3-inch Metal Dial at 50 cents extra, or a 3-inch Bakelite Dial at $1.00 extra. Large Knobs. Both excellent values. Or we will, if desired, supply the Condenser with smooth 3-16 inch center staff, without Scale, Knob and Pointer, at 15 cents off the list to those who prefer to supply their own dial.

Vernier with single movable plate applied to 13, 23 or 43 plate condenser, $3.00 extra.

We allow no discounts except 5 percent on orders of 6 or more.



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SENT PREPAID ON RECEIPT OF PRICE

Except: Pacific States, Alaska, Hawaii, Philippines and Canal Zone, add 10c. Canada add 25c.
Foreign Orders other than Canada not solicited.

G. F. JOHNSON, 625 Black Ave., Springfield, Ill.

RADIO PANELS

and

Other Insulation for Wireless Work

BAKELITE-DILECTO

Grade XX Black was used by the Government during the war for this purpose. It is the

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LIBERTY TOP & TIRE CO., Dept. R-1, Cincinnati, O.

HAVE YOU SOMETHING TO SELL OR EXCHANGE?
A classified ad in Radio News will reach over 235,000 at a cost of only twelve cents a word.

Elko, Nev.....KDEJ
Radio Telegraph, Arc Undamped....3,000
Reno, Nev.....KDEK
Radio Telegraph, Arc Undamped....3,200

**Abstracted from the Radio Information Circular, No. 1 (Revised) of the U. S. Department of Agriculture, Bureau of Markets and Crop Estimates.*

The Benefits of the Radio Telephone in Rural Communities

(*Continued from page* 55)

fostered by the United States Department of Agriculture is that of organizing "Farm Rad Clubs," units of boys and girls in the countryside that are interested in the science and benefits of radio telephony. A representative of the States Relations Service of the Department of Agriculture has been detailed to stimulate this movement. Not unlike the assistance rendered in the organization of calf and pig clubs and tomato and sewing clubs, the Federal Government is extending aid in the formation of "Farm Rad Clubs" on American farms. A representative from the Department of Agriculture, detailed on the mission of visiting certain States in the interest of organizing these units of juvenile concern, had just returned to Washington to make official report when data were being assembled for this article. It is apparent that sentiment favoring the widespread use of radio telephones in rural communities will be gradual in growth, but of far-reaching consequence once the idea has become firmly intrenched as to the advantages to be derived therefrom.

Hence, the timeliness and importance of the appeal of Mr. Wheeler for a wider recognition of the possibilities of radio telephony in the interior portion of the United States whose interests can be advanced by more liberal assignments of wave-lengths for this expanding service. "Because of the emphasis that has been placed in the past upon radio as a means of marine and aerial communication, almost to the exclusion of other uses, the past development has been largely for these uses and the assignment of wave-lengths and other positions or privileges has been determined by such uses," declares Mr. Wheeler. His frank statement continues as follows:

"This is being brought to the attention of those who are engaged in Governmental and public work and who have taken an interest in the development of public radio-broadcasting, in order that expressions may be received on the tentative report of the conference. Special attention is directed to the assignment of wave-lengths from 1050 to 1500 meters, representing a kilocycle frequency of 285 to 200 kilocycles per second, for Government and public broadcasting. If one assumes that a band of 10 kilocycles should be left for each service, this makes possible only eight or nine services of this type in the same zone. This band is not exclusive, and even if made so it will be necessary entirely for Government broadcasting without considering the requirements of the so-called public services.

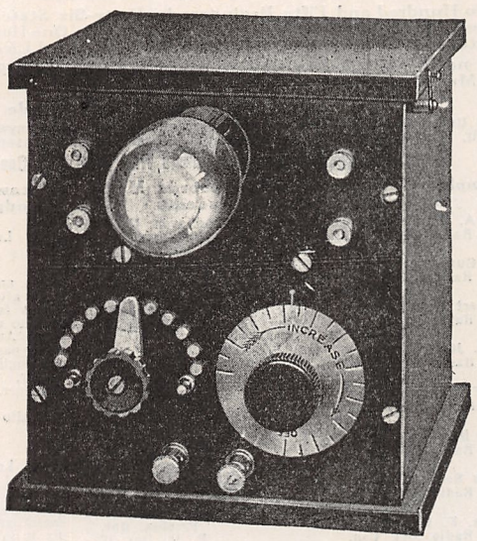
"A band of 700 or 750 meters wave-length, representing a frequency of 428 to 400 kilocycles per second, is assigned for use 700 miles inland. This will provide for a few services in the north-central portion of the United States bounded on the east, south and west approximately by Chicago, Kansas City and Denver. The value of this band is, therefore, limited to a few services in a very small part of the country.

"The band from 310 to 435 meters wave-length is assigned to private and toll broadcasting with the provision that public broadcasting may temporarily be permitted to be done at the wave-lengths in this zone with

MIRACO VACUUM Tube Radio Receiver

$20 (Prepaid)

The Best for the Price
Ready to Ship at Once



Price includes 22½-volt "B" Battery, 150 feet aerial wire and insulators

THE air is full of music and speech. You have but to install the right kind of radio equipment and you can hear it all. The Miraco vacuum tube receiver shown is sensitive to every detail. With this instrument properly installed, you miss nothing. Easy to operate. Merely connect to 'phones, batteries, aerial and ground and you are ready to enjoy concerts, lectures, market and weather reports that flash through the air within a radius of several hundred miles.

The Miraco Receiver is designed for perfect radiophone reception from 150 to 600 meters. It is a handsome, well-made receiver. Its vacuum tube detector, the most sensitive made, does away with bothersome crystal detector adjustments. Beautiful in appearance and durable, but at the low price of $20.00. All you need for tuning up with the "music in the air" are 'phones, vacuum tube and a 6-volt storage battery or dry cells.

Radio Dealers Wanted to Represent Miraco

WE have a good proposition open to live dealers who want to handle a line of receivers that will sell readily and give satisfaction to their trade. Miraco Vacuum Tube Receivers are sold at a price to insure you good profits. They are so handsomely and durably built that you will be proud to sell them. Write or wire us at once for terms and descriptive booklet. It may be too late tomorrow.

Write or Wire Now for Proposition and Descriptive Literature

MIDWEST RADIO COMPANY

Display Room, 710 Vine Street

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MEMORIZE CONTINENTAL CODE ALMOST INSTANTLY **BKUMA YRLSBUG**

Two Hundred and Fifty Beginners in Forty-Six States and Territories have reported Mastered Code in 30 Minutes. In 45 Minutes. In One Hour. In One Evening, Etc. Many have installed stations and with little practice obtained License as Radio Operators.

Do not be satisfied to limit the use of your Radio Receiving Set to Periodical Broadcasts of Music, Weather and Market Reports, Etc.

Master Continental Wireless Code Easily and Quickly

and Understand Everything you may hear at any time from anywhere. Eventually add a sending set to your outfit. Get in touch with the World. Talk Back, Ask and Answer.

Attentive Self-Instructed Beginners Who Use Dodge One Dollar Radio Short Cut Do Arrive

Sample, Code Memorizing Records Made by Dodge Short Cut Students

W. A. Oettler, Radio 2AOI — Woodhaven, N. Y., 340 Woodland Ave. — Time, thirty minutes
E. Gundrum, Radio 2BXY — Elizabeth, N. J., 303 Cherry St. — Time, one hour
Robert Gerbrick, Radio 3BHP — Philadelphia, Pa., 2118 Hicks St. — Time, less than two hours
Mrs. Julia Garrett, Radio 5PJ — Fort Worth, Tex., 303 So. Jennings Ave. — Time, odd moments ten days
J. E. Farquhar, Radio 3DW Canada — Hamilton, Ont., 18 Albert St. — Time, one hour and half
Jos. Dobry, Radio 4BS Can. — Edmonton, Alta., 10023 116th St. — Time, one evening
Wah Soon Shin, Radio 6BDT — Honolulu, T. H., 1941 Faushal Lane — Time, odd moments four days
Thos. F. Baird, Radio 3KL Can. — Preston, Ont., P. O. Box 78 — Time, less than one hour
J. Robert Ziegler, Radio 3AIO — Lancaster, Pa., 129 Dauphin St. — Time, thirty minutes
W. M. Adler, Radio 2BGC — New York, N. Y., 576 E. 143d St. — Time, forty minutes
David E. Day, Radio 4BM — Winston-Salem, N. C., P. O. Box 43 — Time, forty-five minutes
Roland Richardson, Radio 6AVH — Oakland, Calif., 4258 Foothill Blvd. — Time, one hour

Examples of Quick Success by Use of Dodge Short Cut and Limited Practice

Code Learned, Exam. Passed, License Obtained in Two Weeks

To encourage other beginners, I am glad to say that after studying your Code Memorizing Chart for about forty minutes, was surprised how well I was able to understand messages which vibrate through the air. And what is more important about two weeks later passed examination and received my license. For thoroughly learning the Code and that quickly and easily, would recommend your Short Cut to any beginner.

William M. Adler, New York City.
Radio 2BGC — 576 East 148d St.

Code Learned, Exam. Passed, License Obtained in One Week

Before I knew of your Short Cut method had made many attempts to memorize the Code. I could not fix it in my mind, however, and having a Radio Set, realized just how much pleasure I was missing by being thus handicapped. So on seeing your ad in Radio News I immediately sent for your method, although was rather skeptical about it. But when it came to hand and I saw how perfectly simple the Code had been made I was certainly pleased. Took me just 30 minutes or one-half hour to fix the Code perfectly and permanently in my mind and in about a week, or maybe a little longer, I could copy and send at the regulation speed to obtain my Govt. License 3AIO. Shall certainly recommend your method at every opportunity and wish you success.

J. Robert Ziegler, Lancaster, Pa.
Radio 3AIO — 129 Dauphin St.

INVESTIGATE—SAVE TIME AND EXPENSE—GET RESULTS

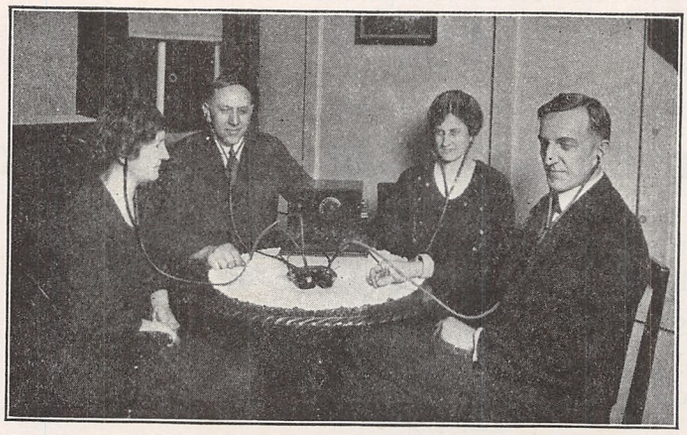
Avoid Disappointment. Before purchasing any Code learning method demand evidence of successful use by beginner, also time required.

For Ten Red Stamps will mail Booklet containing information and Reports from 250 successfully self-instructed beginners—many of them now licensed operators.

No Instruments needed to learn the Code. Entire necessary expense for Code instruction **One Dollar**, and limited study of Dodge Short Cut.

C. K. DODGE **Box 200** **MAMARONECK, N. Y.**

The Tube-O-Phone



The Tube-O-Phone replaces Amplifiers or Loud Speakers for entertaining friends. It keeps the tones clear and natural without distortion or "tin-panny" effect. It also enables two or more persons to hear distant stations that loud speakers do not get. Works fine on crystal sets. Fits any receiver.

The Tube-O-Phone mouthpiece, like a cornet mouthpiece, concentrates all the sound waves with minimum losses. "It's a Scientific Device."

Tube-O-Phone, $2.50 (includes equipment for two persons to use one receiver)

SCIENTIFIC DEVICES COMPANY BOX 129 WILKINSBURG, PA.

Ask Your Dealer For JENKINS REX CHICAGO Radio Equipment

JENKINS MANUFACTURING CO.
4607 Ravenswood Avenue CHICAGO, ILL.

RADIO BATTERIES SAVE HALF. Buy Royal Batteries direct. 6 V. 100 A. H. $18.80. 6 V. 120 A. H. $21.85. Two year guarantee. Full size. Send $5.00 deposit, balance C. O. D. express. Satisfaction guaranteed.

K. E. BATTERY CO., DEPT. 130
646 N. MICHIGAN BLVD. - - - CHICAGO

a change to the assigned longer wave-lengths at a later date.

"I recognize fully the needs of the various mobile services in the protection of life and do not wish to encroach unnecessarily on any of these. Not being a radio engineer, I have consulted freely with others who are qualified along this line and am assured that it is possible to assign a good band of wave-lengths below 1000 meters for public services that would come much more nearly getting at the needs of such services and not injure any of the services otherwise provided for. I recognize also that some of the slightly longer wave-lengths such as those in the band from 1050 to 1500 meters, may, from a strictly engineering point of view, for long range work be more desirable than some of the shorter waves. However, a large portion of the receiving equipment that is in the hands of the public at the present time is adapted only for short-wave reception. This fact must be recognized, at least temporarily and perhaps permanently. Also the point must not be overlooked that the number of kilocycles available is much greater in the shorter wave-length bands than in the higher, and that for services within the ranges assigned to public service—that is, 250-mile radius—the shorter wave-lengths are very satisfactory.

"The amateur field has been well protected in wave-length assignments and I approve heartily of this proposal. I also approve fully of the classification of services, the zoning, and of practically all other features of the report.

"It is evident that the present law does not give the Secretary of Commerce any real power in the regulation of radio. Immediate legislation should be secured to give him: First, the power to use his discretion in the granting of licenses; second, the power to revoke licenses for cause; third, the classification of services and the placing of these in order of importance; and fourth, the regulation of apparatus most likely to cause interference and the prohibition of the use of such apparatus as soon as assurances have been obtained that other apparatus will be available to the public."

Contributed by S. R. WINTERS.

Construction of an Audio Frequency Amplifier

(*Continued from page* 56)

the telephones being plugged-in the desired step of the amplifier.

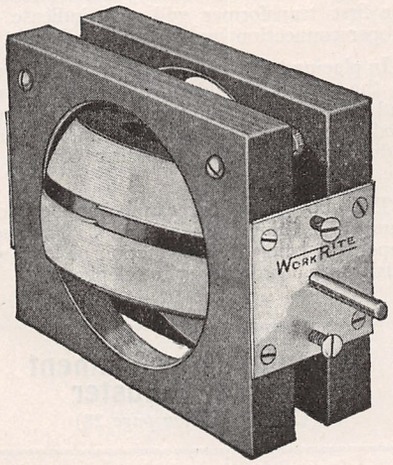
The loud-speaker binding posts can be connected several ways. They can be placed in series with the jack of the second step, which is the best method, or they can be placed in shunt to the jack. If the series method is used, they must be short-circuited to use the regular jack. The two binding posts mounted on the back of the panel, between the receptacles are the "B" or plate battery connections. By mounting the transformer at the side of the board, sufficient room is left for three blocks of the small size batteries. The voltage should not be less than 50 in any case. When these batteries run down, a scratching or grinding noise will be noticed in the phones. In specifying just what voltage should be impressed on the plates, it is necessary to know the type of tubes to be used, but for "Radiotrons" and "A P" tubes the 50 volts will be satisfactory.

The graduations for the rheostat pointers were made by scratching along a straight edge with a divider point, or other sharpened instrument. The scratch should be made light, and gone over several times, to secure a clean cut line, and then filled with white lead. If a heavy cut is made, a ragged line will result.

The case is shown in the photo. It is made of 3/8" oak, with thicker bottom. The

WORKRITE RADIO PARTS WORKRITE

THEY ARE STANDARD IN EVERY CORNER OF THE UNITED STATES AND CANADA



WorkRite Super Variometer

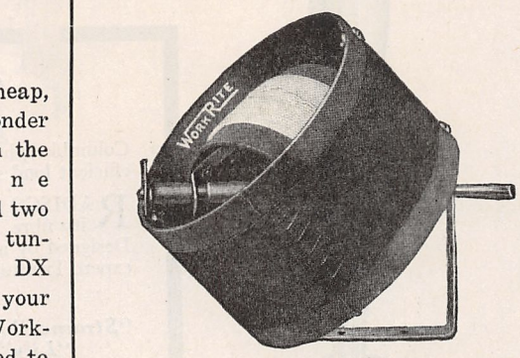
Made from the finest quality solid mahogany, hand rubbed and polished — a beautiful instrument. All metal parts made from brass, highly polished and nickel plated. Just the right number of wire turns and air gap to insure fine tuning. Spring contacts at each connection between rotor and stator. Has 3/16" shaft. Easy to attach to panel. Binding posts between stator halves. Packed in attractive boxes. PRICE, **$5.25**; with Dial, **$6.00.**

Radio Fans!

Why waste your money on cheap, imitation parts, and then wonder why your set will not bring in the long - distance concerts. One "WORKRITE" Variocoupler and two "WORKRITE" Variometers for tuning will pick up concerts and DX signals clear and strong which your neighbor will not even hear. Work-Rite Parts absolutely guaranteed to give satisfaction. Insist that your dealer furnish Genuine "WORK-RITE" Parts. If he will not, go to another dealer or write us.

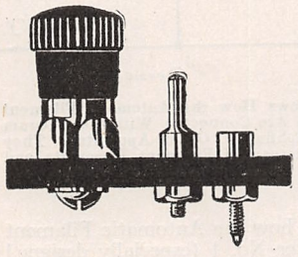
Jobbers—Dealers!

Can you afford to risk your reputation in selling parts made in basements and back yards—or by firms who know nothing of radio? Stock and sell WorkRite Radio Parts. You are sure of a heavy demand and a satisfied customer every time. Write or wire for discounts, or send in your order. Our large factory insures good delivery.



WorkRite 180° Super Variocoupler

Both primary and secondary made from black Formica and wound with just the right number of turns and sizes of wire to secure maximum efficiency. The 180 feature makes the "WORKRITE" tune just twice as fine as the ordinary 90 coupler. THIS IS A BIG ADVANTAGE. Has 3/16" shaft. Easy to mount on either panel or base. All metal parts made from brass, highly polished and nickeled. Spring contacts at each connection to eliminate scratchy noises. Binding posts for easy connections. Packed in attractive boxes. PRICE, **$5.00**; with Dial, **$5.75.**

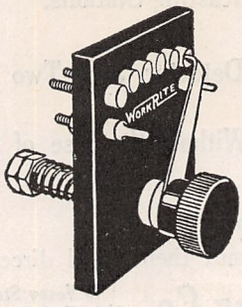


WorkRite Binding Posts, 10c.

WorkRite Switch Points, 3c.

WorkRite Switch Stops, 4c.

Binding Post has hard rubber top. All other parts made from brass, highly nickel plated.

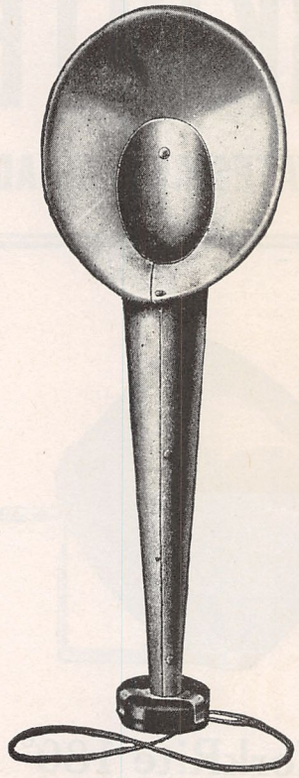


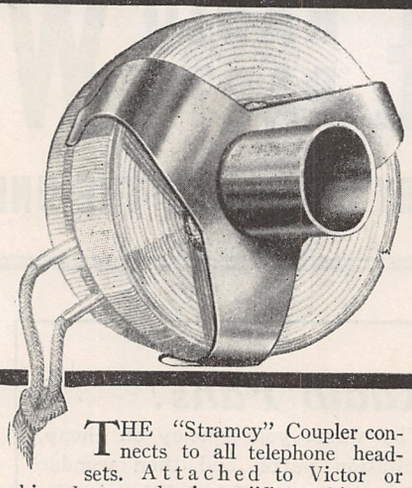
Just what you want. Remove the parts and use the block as a template for drilling your panel. Put up in neat individual boxes. **Complete WorkRite Switch Sets, 80c. Switch Lever with Bushing, 40c.**

Type "A" WorkRite Hydrometer

Double the life of your battery by giving it proper care. Fill and test it regularly with a WorkRite Hydrometer. Never let it become discharged below 1150, or it will soon be ruined. Full instructions for testing and care of battery with each "WORK-RITE." Get one now! PRICE **$1.00**

THE WORKRITE MFG. CO., 5521 EUCLID AVENUE, CLEVELAND, OHIO





THE "Stramcy" Coupler connects to all telephone headsets. Attached to Victor or Columbia phonographs in a jiffy, making an efficient loud speaker. **Price, 60c**

RADISCO "Lily" Horn is made of high quality fibre, with a wall of air between layers. Designed by a well-known New York acoustical expert. True tone amplification without distortion.

Price, 95c

"Stramcy" Coupler and RADISCO "Lily" Horn, Complete..... $1.55

RADIO DISTRIBUTING CO.
NEWARK, N. J.

RADISCO

WHAT YOU HAVE BEEN LOOKING FOR—A REAL

AMATEUR RADIO DIRECTORY

AND CALL BOOK

Complete List of All Amateur Stations in the United States, Including Special Amateur and Broadcasting Stations.

—Also—

How to Build a Regenerative Set, Detector and Two Stage Amplifier.

How to Calibrate Your Receiving Set Without the Use of a Wavemeter.

Price $1.00 Per Copy

Order from your dealer—if your dealer hasn't them, send direct.

Radio Directory and Publishing Co., 45 Vesey Street New York City, N.Y.

Do not send stamps. Dealers—write for proposition. Dept. R.

International Radio Corporation

DEALERS—Write for Prices

We manufacture receiving sets, variable condensers, variocouplers, variometers, sockets, rheostats and parts for assemble of radio receiving apparatus.

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RADIO FOR THE NATION

Stores in five large cities enable this organization to supply radio equipment, both wholesale and retail, with the greatest speed and economy.

20th Century Radio Corporation
565 Fifth Avenue, New York City
Straus Bldg., Suite 710

Stores in Norwalk, Conn., Detroit, Mich., Newark, N. J., Brooklyn, N. Y., White Plains, N. Y.

case is 7" deep, from the front of the panel, to the outside, and will hold all the apparatus, including the plate battery, without crowding.

The original amplifier was wired with No. 14 bare copper wire, and insulated with spaghetti, all joints and terminals being securely soldered.

In connecting the transformers, if the terminal of the first transformer, marked "7" or "A" is connected to the plate of the first tube, the terminals and tube elements of the second step should be in a like relation. In case the terminals are not marked, experimenting with the secondary connections of the first transformer will soon indicate the proper connection by the loudest signals.

In placing tubes in any receptacle, the ends of the prongs should always be examined, and the prongs of the socket likewise examined, to make sure they are clean, and have sufficient tension to make firm contact on the tube.

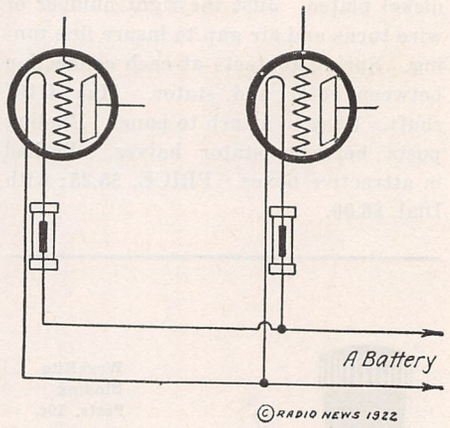
The above amplifier can be applied to a number of things besides radio. The most important being the production of loud signals from an ordinary wire telephone.

An Automatic Filament Current Adjuster

(*Continued from page* 28)

is confined to approximately 400 degrees centigrade. What operator can keep within these limits? It is, therefore, logical to expect the trouble experienced in using the modern vacuum bulbs. If operated properly they should last as long as any standard make of incandescent tungsten lamp.

A regulating device is required with the modern vacuum tube in order to compensate for the variation in the "A" battery voltage, as shown in Fig. 5, and the slight variations in the different tubes.

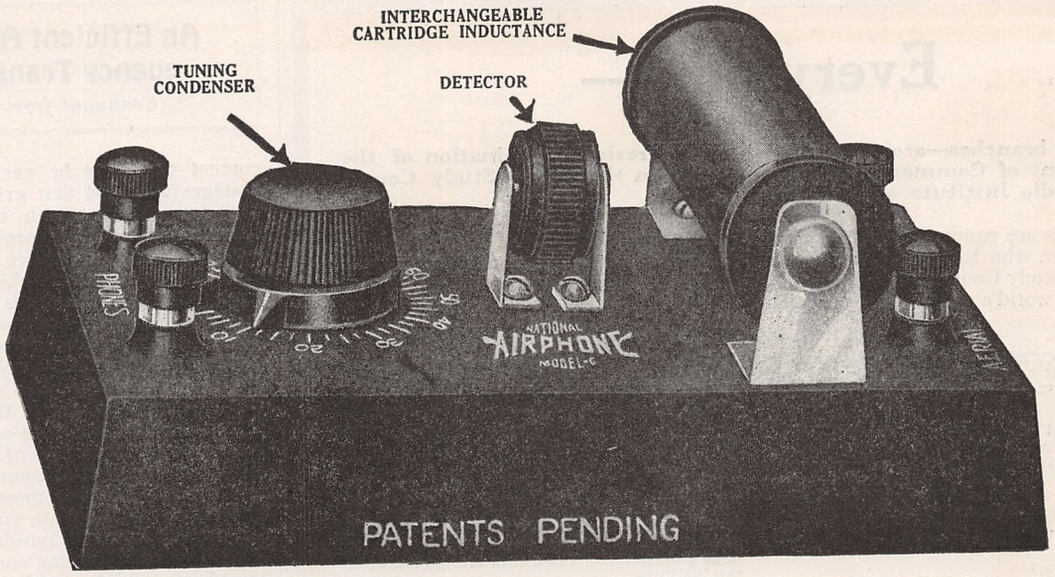


This Diagram Shows How the Automatic Filament Current Adjusters Are Connected With the Vacuum Tubes in an Amplifier or Other Apparatus. They May Be Used Instead of Filament Rheostats and Regulate the Current Automatically.

Fig. 6 shows how the Automatic Filament Current Adjuster No. 1 (especially designed for tubes taking approximately 5 volts, 1 amp.) keeps the current within eight one-hundredths of an ampere, irrespective of the variation in battery voltage.

From a theoretical and practical standpoint, the Automatic Filament Current Adjuster meets almost every requirement of radio use. It is carefully and scientifically designed to be operated under actual conditions with the various tubes on the market. This device is always connected in series with the "A" battery and V. T. filament, as shown in the accompanying sketch.

—Data and photographs by courtesy of the ***Radiall Co.***



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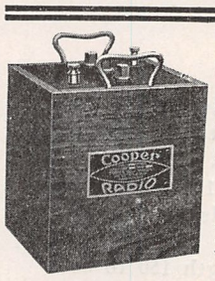

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An Efficient Audio Frequency Transformer

(*Continued from page* 57)

current that may be varied by impressing voltages upon the first grid. A corresponding potential variation is induced in the closely coupled transformer secondary, the terminal voltage of which is impressed upon the grid of the next tube. While the tube itself is an amplifier, it is desirable that the voltage should be increased by transformation. To do this the transformer must be carefully designed for maximum efficiency at the probable frequencies it is to amplify. For maximum power in the primary circuit it must be designed with an impedance equal to or greater than that of the filament-plate circuit in which it is connected. What does this mean? What is meant by the internal impedance of the plate circuit, and that of the transformer? Consider the first tube: The filament is burning and the plate is maintained at a high positive potential by the battery B. Electrons are projected outward from the heated filament and are continually attracted into the positive plate. If the filament temperature and plate potential are constant, and the grid not affected, the movement of the electrons may be considered constant also. This motion is equivalent to a feeble current called the "space current" within the tube. Because of this, the effect is similar to conductance through a high resistance, and this apparent resistance is called the internal plate resistance. If the filament temperature or plate potential vary, so will the space current and apparent resistance vary. However, these two are maintained constant in practice and the space current varied by the grid electrode. For the above reasons the resistance may not be the same within all tubes in the circuit, but may be considered as 40,000 ohms for the Moorhead amplifier V.T. tubes generally employed, and much less than that for the soft gas content tubes used for detectors. The plate-to-filament capacity of this same tube is 4.2 micro-microfarads, so that it is similar to a very small condenser shunted by a high resistance. The capacitive reactance at possible frequencies remains comparatively high and may be disregarded in this case, the resistive value being assumed as much lower. As this internal value is non-reactive, it may be considered constant for audio frequencies. To make the primary of the transformer of this same impedance, it is necessary to carefully design the primary turns and iron core structure. This inductance value should be made above 10 to 15 henries. Generally the ohmic resistance of the winding is low in comparison, and may be considered as a "by product" of the turns. Although it should be as low as possible, the gain in efficiency by using finer wire more than compensates for the loss in the copper. Now, the ear is very sensitive to frequencies corresponding to 500 cycles, so this, together with common commercial spark frequencies of 1,000, may be considered as the frequency of the A. C. component in the plate circuit while amplifying spark or C.W. signals. However, if this is too rigidly considered, distortion may be found when the amplifier is used for radio telephone reception where vocal and instrumental frequencies are very broad in range and may be disproportionally amplified above other tones also transmitted. In practice, the transformer primary impedance should be once or twice that of the normal tube impedance.

Consider the grid-filament circuit of the tube to which the secondary is coupled in Fig. 2. Similarly to the primary circuit,

May 1, 1922

Warning to Patent Infringers

VARIOUS types of crystal detectors, renewals therefor, and crystal detector radiophone receiving sets now being offered for sale employ the inventions of one or several of the following United States patents (commonly referred to as the Pickard patents) the property of the Wireless Specialty Apparatus Company.

836,531	904,222	924,827
886,154	912,613	1,104,073
888,191	912,726	1,137,714
13,798 (reissue of 877,451)	963,173	1,225,852
933,263	1,104,065	1,257,526
1,213,250	1,118,228	1,136,044
1,136,045	1,136,046	1,136,047

The above patents cover, among other things, the most efficient circuit arrangement of apparatus commonly used in crystal detector radiophone sets, various kinds of crystal members, means for mounting the crystals and holding the mounting, special forms of contacting conductors for the crystals, and mechanism permitting the user's selection of contact points of the contacting conductor on the crystals.

Authorized crystal detectors now are available through the distributors of the Wireless Specialty Apparatus Company, also renewals therefor, and complete crystal detector radiophone receiving sets, all in large quantities, which are sold under the various above-mentioned patents.

The Wireless Specialty Apparatus Company purposes to prosecute, vigorously, all infringers of its patents and, therefore, those manufacturers, distributors, jobbers and dealers who have not been authorized as yet are warned to cease the manufacture or the sale or distribution of crystal detectors, renewals therefor, or crystal detector radiophone receiving sets or any other radio devices which infringe these patents.

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For their own protection, the distributors, jobbers and dealers who yet may be offering for sale unauthorized crystal detectors, renewals therefor, or complete crystal detector radiophone receiving sets, should demand a guarantee from the manufacturer from whom they purchase radio equipment holding them harmless in case of damage suits arising through their distribution and sale of radio apparatus which infringes the above-mentioned patents.

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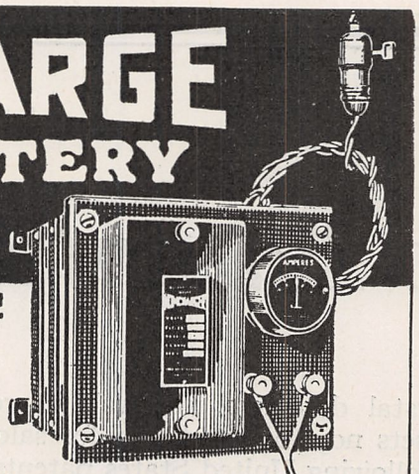

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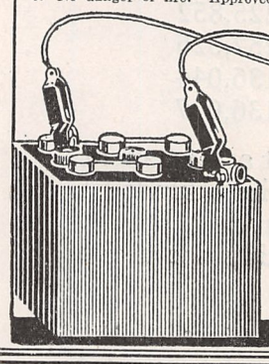

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this must also be reasonably designed, but here we have a special case often overlooked. For the ideal transformation the secondary impedance should be made equal to the load (grid-filament) circuit impedance. Theoretically, then, we find that for ideal transformation, disregarding losses, the ratio of these two impedances is the square of the transformer winding ratio. In practice this could not stand a comparative test, owing to the departure from an ideal case to be mentioned again.

What is the grid-filament circuit impedance? The grid in the sketch is maintained at a negative potential in relation to the filament, hence there is negligible space current which would give an apparently low resistance. Other than its capacitive reactance which is very high at normal frequencies, its internal grid impedance may be considered due to gas content, leakage over the glass supports, leads, or socket mounting. This may be safely considered above several hundred thousand, and may be considerably over one million ohms if the grid never becomes positive. So in proportioning the ratio of turns accordingly, we would find ratios of 10 or 15 would be required. This will not do for the following reasons: If we found that 4,000 turns were required for the primary, 40,000 would be required for the secondary to satisfy this generally accepted theory of designing. To construct such a coil, even with the fine wire used, the winding space would be necessarily large. As a result of so much copper the resistance would be very high; so that, on induction, the terminal voltage would be greatly reduced by the internal drop of the winding. In fact, the terminal voltage may be less than the primary voltage, which would be considered a poorly designed affair. This is one defect caused by winding with too high ratios. Theoretically the voltage should be higher but is not. Again, as a result of so many turns there would be a large volume of winding. There are many layers of fine wire, which, with the bulk of winding, gives a fairly large distributed capacity which is shunted by the grid capacity itself. This tends to load the secondary considerably and increases the internal drop along with capacitive losses. Capacity in the grid circuit is detrimental, for the reactance should be maintained proportionally large as compared to the resistance there; and, as this last value is also high, a lowering of the capacitive reactance tends to alter the constants of the circuit at various frequencies. Also, an increase of winding dimensions causes greater leakage losses.

In practice, it is not safe to provide ratios greater than 5. For such ratios, greater than 5, the tendency is to reproduce static and tube noises, but does not amplify signals proportionally; and, most of all, tends to turn speech into crispy shrill tones greatly distorted. It is true that the primary impedance should be made high, and that efficiency increases with this reactance, but it reaches a value where it is uneconomical to increase it further. If it is too low, along with decreased power, we have the tendency to readily pass strays of any kind. The primary reactance may be increased by increasing the number of turns in the primary, or by increasing the cross section of iron in the core. If the turns are increased too much, the secondary, to maintain its ratio, must be increased also with their resulting losses mentioned before. The iron may, then, be made of reasonably large cross section to reduce secondary dimensions. My best transformers have ratios below 5. I have found 3.5 and 4.2 satisfactory for the transformers described here.

Illustrations show several finished transformers; also several in different stages of construction. In this design a primary is wound upon a fibre tube; a secondary is then wound over the primary; and a bundle of iron core wires is passed through the tube and bent about the unit to completely enclose it within the iron shell. Simple, but not so simple.

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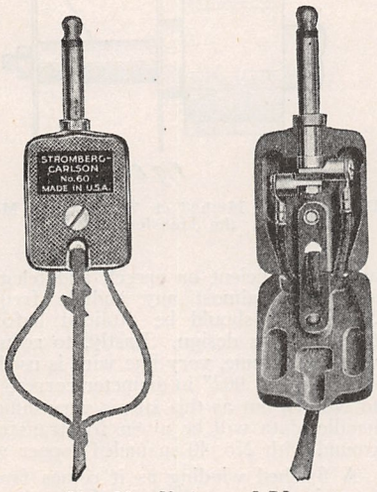

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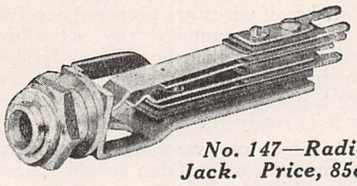

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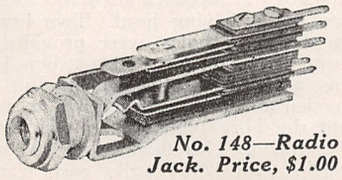

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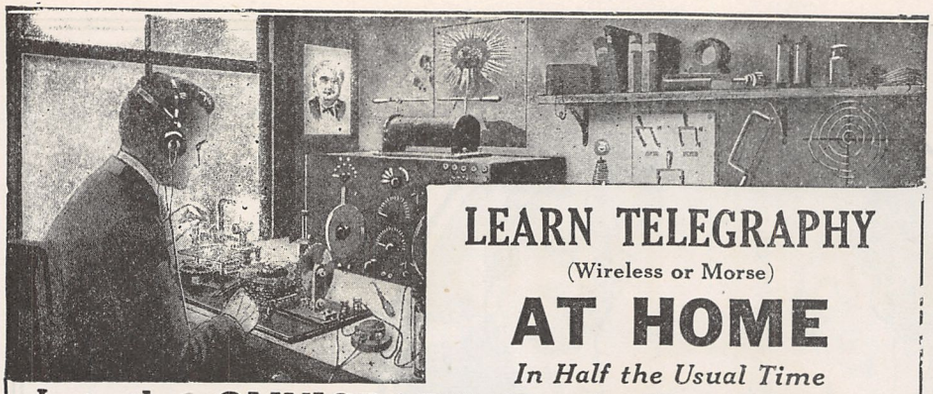

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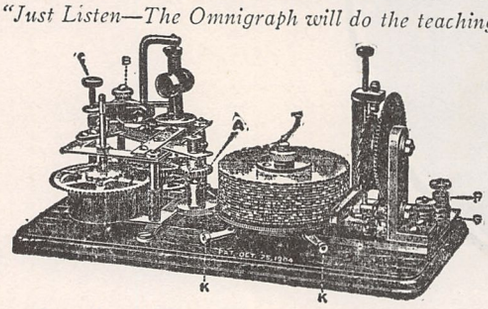

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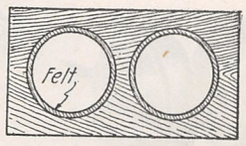

Fig. 5

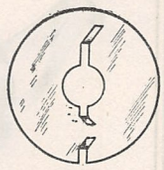

Fig. 4

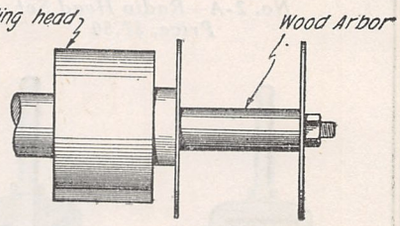

Fig. 8

Details of the Method of Winding and Mounting the Transformers.

are very efficient on speech and telegraphic signals of almost any audible frequency. Some skill should be attained before attempting this design. Lastly, to reduce the winding volume, very fine wire is used. The ideal wire is .002″ in diameter corresponding to No. 44, but as this size is very difficult to handle, data will be given for transformers wound with No. 40 enameled copper wire.

A finished winding as it comes from the form is shown at the left of Fig. 1. After completing the winding, it is wrapped with several layers of oiled paper and then encased in a fibre sheath. A bundle of insulated iron wires are prepared carefully and bent around symmetrically as illustrated. Strong cord is then bound tightly about the transformer and the entire device covered with a heavy insulating varnish. After drying it is ready for use.

The procedure was as follows: A winding machine was made from an old Singer sewing machine head and a revolution counter attached. A threaded brass rod was screwed into the revolving head. Two brass discs, bored full of holes, were provided for the form ends, and a wooden arbor 1⅜″ long was assembled as shown in Fig. 8. The wooden arbor is turned down to fit snugly into the fibre tubing upon which the coils are wound. This tubing is 7/16″ inside diameter with 1/16″ walls, each transformer using a length of 1⅜″.

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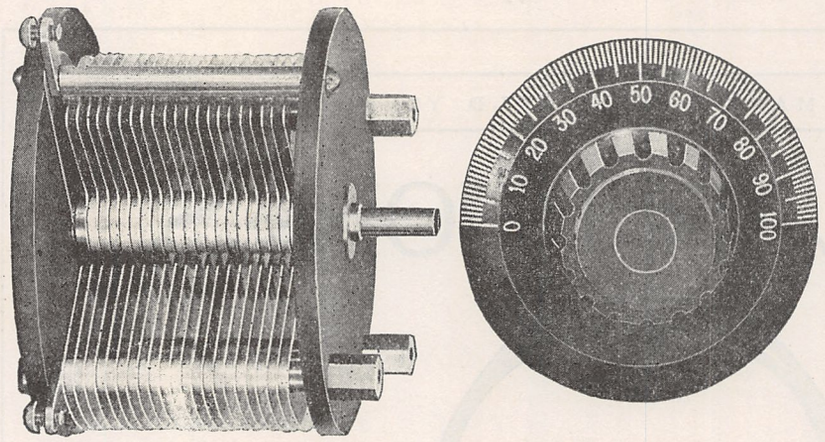

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Do you know there is a chart showing the location of every Broadcasting Station in the United States, together with the wave lengths they send at, that will tell you at a glance what stations you can "get" on your set?

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Full instructions furnished with each chart. Sent prepaid upon receipt of 35c in stamps or money order.

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Come and see us for your Radio Equipment—we'll give you service you will like.

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A welcome addition to your library! Send $2.50 today, plus postage for 7 pounds, and your copy of bound volume No. 2 of Radio News will come forward by return mail.
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A short length of Litz wire is passed through the disc and soldered carefully to a foot length of No. 30 copper wire. After winding this evenly for a few turns, the finer No. 40 is very carefully brushed with emery paper and soldered to the last length of No. 30. This method is necessary in starting and finishing the winding. Fig. 7A shows where No. 40 is soldered directly to a heavy wire. This is too abrupt and will invariably break. A stronger junction is shown by Fig. B and C where the fine wire is brushed clean and wrapped over the larger wire and then back upon itself. Rosin cored solder must be used with a small iron. When the solder runs, the iron is moved along the finer wire, thus leaving a long fine taper of solder as shown in Fig. C. Such a precaution is very often disregarded until too late to repair a possible break. Never use other than rosin for flux. Acid quickly destroys fine wire. After starting the fine wire, it is wound evenly into layers. On reaching a point 1/16″ from the form end, a strip of prepared paper long enough to enclose the first layer is turned in and the next layer wound. This paper is Oiled Empire No. 100, .001″ thick, cut into 200 yard rolls 1⅜″ wide. On finishing the primary, a length of No. 30 is soldered in and finished with a length of fine Litz. Several layers of heavier paper are wound to separate the secondary 1/32″ from the completed primary. The counter is then set at zero and the required number of secondary turns wound in the same manner as before. On completing the winding, several layers of thick paper are wound about the outside

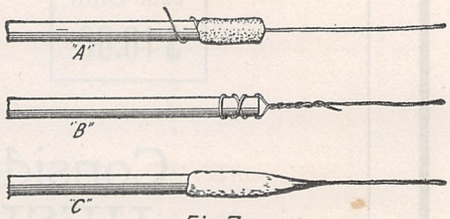

Fig. 7

Showing how to Solder the Leads to the Winding

and then the unit removed from the form. During the winding process, it is often helpful to place a drop of gum shellac at each end of each wound layer. This keeps the turns in place.

Two fibre discs 1/64″ thick are cut with dividers, as shown in Fig. 4. The diameter is ⅛″ greater than the winding diameter. Slots are cut in one to pass the leads as shown. A strip 1⅜″ wide is bound about the coil itself to entirely enclose it and insulate the core more effectually.

The core is made of No. 22 annealed Norway iron wire. As the core encloses the transformer, the length must be great enough to enclose it without overlapping ends. Each wire is straightened by rolling between two boards until a bundle ⅜″ in diameter is prepared. These are dipped in medium light shellac, then spread out and dried. Later, the bundle is passed through the tube and finished. On bending the wires of the core, small spaces may be provided for passing the leads that may then be encased in sleeving.

For mounting, a simple device is shown at Fig. 5. A hole ⅛″ greater than the transformer diameter is bored through a small piece of wood. Felt is wrapped about the transformer that is then forced into the hole. Several transformers may be mounted side by side in this manner.

A very simple and efficient design is shown in Fig. 3A. The primary is first wound of 4,000 turns of No. 40 enameled wire. The secondary is of 17,000 turns similarly wound, giving a ratio of 4.20. Although the first tube may be soft, or all of them differ in their impedances, it is advisable to provide identical transformers throughout. A

"WESTRAD" RADIO APPARATUS

ABOVE THE AVERAGE FOR SERVICE
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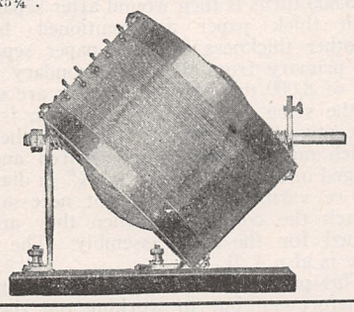
"WESTRAD" VARIO COUPLER

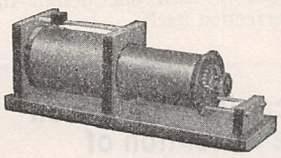
Westrad Vario Coupler, No. 100, price, each $5.00
With Bakelite Dial, No. 500, price, each.. 6.00

A Coupler from 150 to 600 meters. Primary of white cotton covered wire. Continuously wound secondary mounted for 180-degree tuning. Secondary adjusted in the factory to exact center of primary. Support tapped for panel mounting screw; 3/16" shaft. All-metal parts made of brass, nickel-plated. Size, 4x5x5¼".



"WESTRAD" LOOSE COUPLER

No. 800, price, each.....$9.00



Polished mahogany finish. Range of 200 to 2,500 meters. All metal parts are brass, nickeled and highly buffed. Secondary inductance has 10 - point switch mounted on Bakelite coil head. Wound with green silk covered wire.

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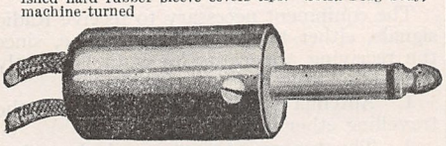
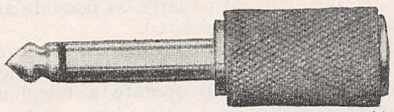
(Patent applied for)

New type of plug taking cord tips directly. Not necessary to remove tips. Handsomely finished. Polished hard rubber sleeve covers tips. Solid Plug body, machine-turned



No. 137 CORD TIP PLUG, each.....$1.25



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Considered the best for Amateur use.

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No. 162, 2,000 ohms.....$5.00
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Shipping weight, per 100 feet, about 8 pounds. Put up in coils.
7-Strand, No. 22, 100 feet
Copper $0.75
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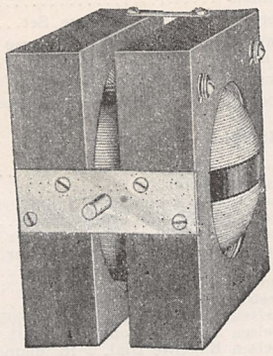

With nickel metal parts. Finished in dark mahogany. Stator and Rotor windings connected by springs. Bronze notched washers give perfect contact in every position. Stator and Rotor blocks have been tested for Dielectric strength and approved by our engineers (no detrimental paint used). Size, 4¾x4¾x3½" wide. Two styles wound with No. 18 and No. 20 natural colored wire.

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Westrad Grid Variometer, No. 1200, wound with No. 20 wire, price, each.....$5.00
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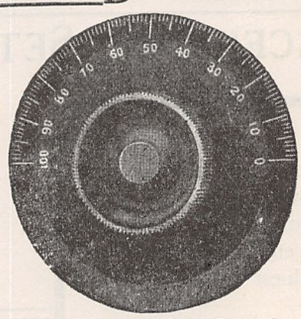

Molded from genuine Bakelite. Positively will not warp or discolor. Non-brittle with highly polished surface. Division scale recessed and filled with white enamel. 100 divisions read from right to left for clockwise rotation. Made with the usual exacting care of all Westrad Apparatus. Absolutely true running. Specify 3/16" or ¼" shaft when ordering.
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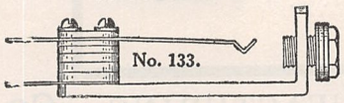
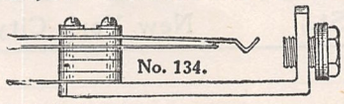
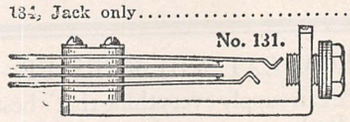


No. 133, Jack only.....65c



No. 134, Jack only.....75c



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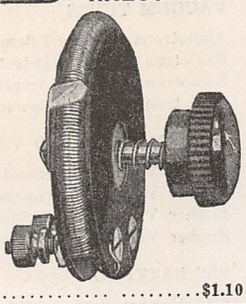
Resistance unit mounted on a disc 2¼" in diameter.
Non - corrosive exposed wire allows free cooling.
Furnished complete with Bakelite white arrow knob and supporting screws.
Must be seen to be appreciated.



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Fit any thickness of panel. Head, 11/16" high. Price, each, including one nut 5c
Per dozen 50c

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For any thickness of panel. ¼" diam. x3/16" high; 2 nuts.
Price, each 4c
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Per dozen 43c

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Highly efficient. Midget No. 405. Diam., 1 5/16". Length, 3¼" over all. Weight, ¼ lb. Price, each...25c
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Designed especially for Radio use. It is not suitable for wire telephone work. Price, each....$6.00

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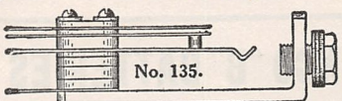

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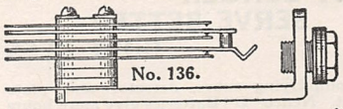

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VACUUM TUBES

Audiotrons (Double Filament Type)	$6.00
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Federal Jr., complete with aerial equipment	$25.00
Aeriola Sr., Westinghouse Set	65.00
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Model 101—102

MUSIC, News Reports, Opera Concerts, Talks brought right to your home. All the above is yours through the Eastern. The Eastern Classic is constructed with the finest instruments made. Each set is enclosed in a solid mahogany cabinet of the utmost ruggedness and beauty.

MODEL 101 is our improved detector unit tube type having a wave-length ranging from 200-1,500 meters. Its receiving capacity will bring the broadcasting from a distance approximately 125 miles. All sets equipped with the new type vernier rheostat, giving a much finer adjustment, which tends to eliminate distortion in the phones. Each set equipped with head phones and aerial equipment. List Price $75.00

Model 102—Two stage amplifier unit. List Price $125.00

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NENCO "B" BATTERIES

LAST LONGER
SERVE BETTER
COST LESS

For amplifying tubes, detector and plate circuit. Nenco "B" Batteries give more hours of service, are moisture proof, silent and free from leaks.

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Write for Special offer and discount

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FROM CAT WHISKERS UP—
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low impedance transformer in the first stage allows noises to enter that could have been blocked by one of higher impedance.

Fig. 3B is an excellent design, but should not be attempted until one is reasonably skillful in handling fine gauges. This type is good for a very broad range of frequencies, being very good for telephone reception as well as spark signals. The secondary is wound into two parts with the primary sandwiched between. First secondary 8,000 turns directly on tube in the usual manner, except the lead which is left long and of No. 30, for it is later returned to the second secondary section. A primary of 3,800 turns is then wound after separating with thick paper as mentioned before. Another thickness of thick paper separates the primary from the last secondary winding of 8,000 turns. Both sections are wound in the same direction. This design is very susceptive to the quantity of iron in the core, which must be critically prepared and arranged into a bundle exactly ⅜" in diameter before varnishing. It is not necessary to repack the core wires when they are returned for the final assembly. The ratio here is also 4.20.

This principle is not new nor original in transformers, but in working out the two designs described above, they were found more efficient than some on the market, and compared favorably with one design that seems to be perfection itself.

Practical Information on the Reception of Radio Signals

(*Continued from page* 60)

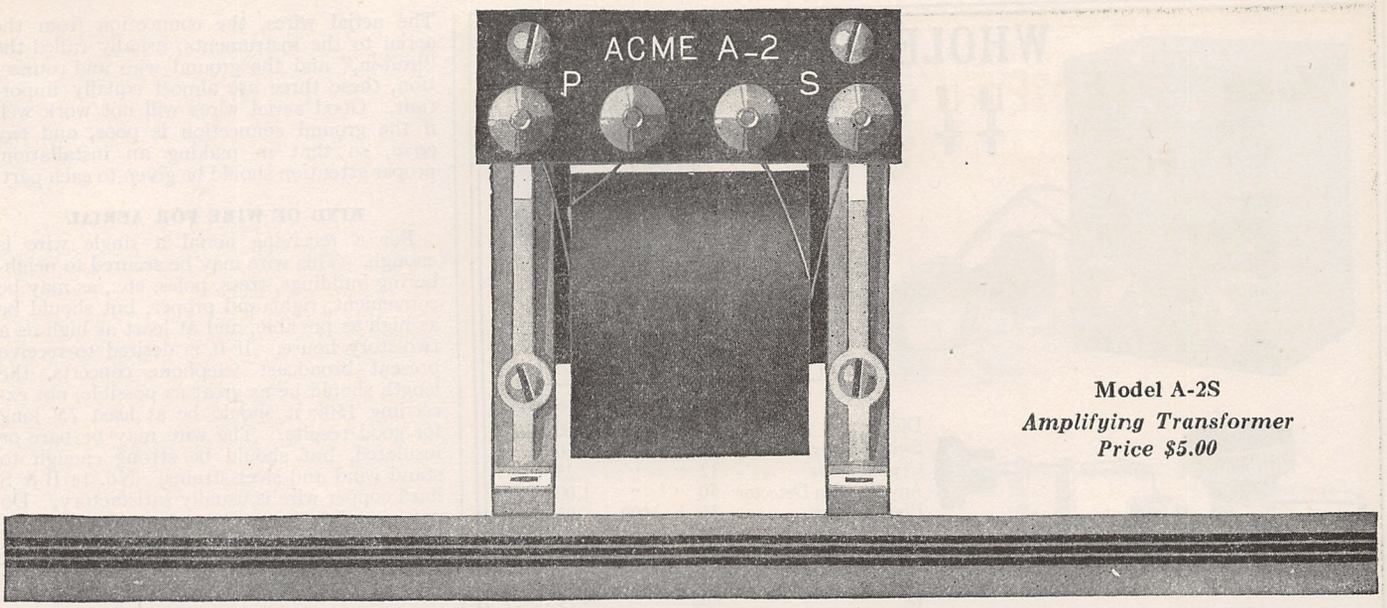
The equipment necessary to receive Radio signals, either telegraph or telephone, since the receiving apparatus for both is exactly the same, consists of these four parts:

1. Antenna system, which picks up the travelling ether waves.
2. The tuning apparatus, which makes the received current as large as possible and picks out the signals desired.
3. The detector, which detects the presence of received current, or converts them into form suitable to operate a telephone receiver.
4. Telephone receivers, which change the received electric current into sound.

The antenna system is for the sole purpose of picking up energy from the ether waves, and fairly simple requirements govern its design and installation, but because the frequency of the currents is so much higher than those of ordinary electric light and power, certain factors of the wiring, etc., must be considered, which can be neglected in ordinary electric installations.

To understand these factors, or in fact, any part of wireless apparatus, the meaning of frequency of electric currents must be clear. Direct current, "D. C.," is current which flows in one direction continuously. Alternating current, "A. C.," is current which flows in one direction and then in the other, repeating this a certain number of times per second, which is called the frequency of the current. Thus, the usual house lighting current is 60 cycles per second, which means that the current flows one way, then the other, 60 times a second. "D. C." is used for some electric applications, and "A. C." is used for others. Some applications can use either D. C. or A. C. Wireless uses A. C., but instead of 60 cycles per second, uses thousands or millions of cycles per second. The human senses cannot appreciate occurrences at such rapid rates, but it is not difficult to realize that special provisions must be made, even for electric currents, to allow them to flow and reverse so rapidly. We shall see what the provisions should be.

An antenna system consists of three parts:



Model A-2S
Amplifying Transformer
Price $5.00

—*and whispers become living voices*

WHEN you add one stage of Acme Amplification to your receiving set, music and dialogue assume a depth and roundness totally lacking in the ordinary detector circuit.

Throw in two stages of Acme Amplification, and sounds come in volume so distinct that you can use a loud speaking device—the ***real*** way to hear broadcasting.

Acme Amplifying Transformers are built with specially designed closed iron cores which prevent howling and distortion. Why not buy the best—they cost no more. For sale at good radio stores.

Manufacturers of

- Acme Amplifying Transformers
- Acme C-W Transmitting Apparatus
- The Acmephone
- Acme One Stage Amplifying Units
- Acme Two Stage Amplifying Units
- Acme Detector Units
- Acme Detector and Two Stage Amplifying Units

THE ACME APPARATUS COMPANY
Cambridge, Mass.
Transformer and Radio Engineers and Manufacturers
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TRANSFORMERS

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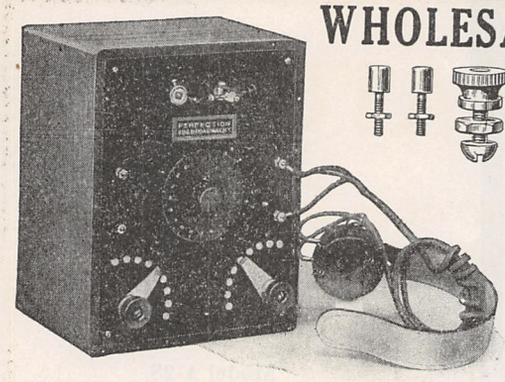

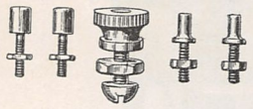

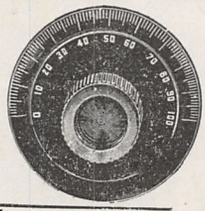

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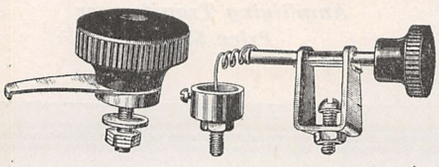

	Wholesale	Retail
Dials	$36 per 100	$1.00 Each
Switch Levers	25 " "	.50 "
Crystal Cups	12 " "	.25 "
Any Position Detector	50 " "	1.00 "
Binding Posts	35 " 1000	.08 "
Contact Points	10 " "	.02 "
23 plate Variable Condenser	$2.25 Each	3.75 "
43 " "	3.00 "	4.75 "

PERFECTION NO. 1 $27.50 33⅓% OFF IN DOZEN LOTS

DESCRIPTION: Complete with Antenna equals any $50.00 instrument, contains tuning coil 18 taps, 23 plate variable condenser, fixed condenser and phones, 2000 to 3000 ohms.

Has received Certificate of Excellency from N. Y. Evening Mail Radio Institute

PERFECTION RADIOFONE CO., 486 Broadway, N. Y. City

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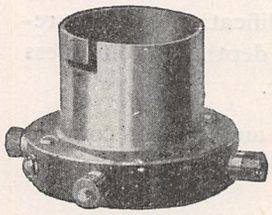
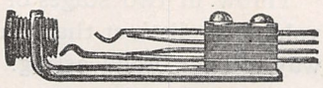


We can offer immediate shipment on orders for any of the items listed below. Postage must be included with all orders.



Bakelite dials—drilled for ¼ in. shafts	$1.00
Plugs and jacks as illustrated—complete	1.50
Plug only	.75
Jack only	.85
Socket as illustrated	1.00
10 to 1 Ratio amplifying transformer—guaranteed	4.50
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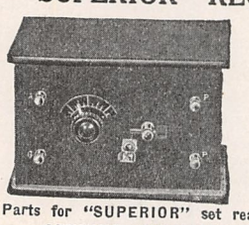

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The aerial wires, the connection from the aerial to the instruments, usually called the "lead-in," and the ground wire and connection, these three are almost equally important. Good aerial wires will not work well if the ground connection is poor, and *vice versa*, so that in making an installation, proper attention should be given to each part.

KIND OF WIRE FOR AERIAL

For a receiving aerial a single wire is enough. This wire may be secured to neighboring buildings, trees, poles, etc., as may be convenient, right and proper, but should be as high as possible, and at least as high as a two-story house. If it is desired to receive present broadcast telephone concerts, the length should be as great as possible, not exceeding 150′; it should be at least 75′ long for good results. The wire may be bare or insulated, but should be strong enough to stand wind and sleet strains. No. 14 B & S hard copper wire is usually satisfactory. Do not use plain iron wire, even galvanized, if best results are desired. The so-called copper-clad wire, a steel wire with a thick coating of copper, is good.

CHOICE OF AERIAL SUPPORTS

Choose the aerial wire supports or attachment points with care. Keep aerial wire as far as possible from electric light and power and telephone wires. In no case should it be nearer than 10′ or 15′ to them, not only because of the danger of making contact with them, but because they will render the antenna system less efficient, and also may cause interfering noises in the receiving set. Also keep the aerial wires as far as possible from trees, buildings, etc., other than the supports. Trees and buildings under the aerial wires are quite apt to reduce the effectiveness of the antenna materially. Put both ends of the aerial wire as high as possible. Do not attach wires to telephone and power line poles without obtaining permission, and then don't do it. If a tree is used, do not forget that the tree may sway several feet under wind. The wire must be *well* insulated from everything until it reaches the receiving set. Small porcelain insulators are the best things to use. If it is necessary to make any splices or connections in the aerial or ground wires, do not fail to solder them, because any unsoldered joint is quite apt to corrode in a few days by action of the air, so that the very small received voltages cannot operate through it. This is very important and should not be neglected, however great one's anxiety to "get it working."

HOUSE-END OF AERIAL

The house-end of the aerial should be supported at a point selected with reference to where the receiving apparatus is to be located in the house. The lead-in should be as simple and direct a wire as possible and must not run *inside* the house for more than a few feet. That is, do not bring the lead-in through one window, around the room, down the hall to another room, to the set, or you will have a poorly operating set. In other words, bring the lead-in through the wall or window near where the set is to be, or locate the set where the lead-in is best arranged. In short, make all antenna system wiring short and direct. This applies also to the ground lead. Very often a satisfactory ground can be obtained by connecting the ground wire to water, gas or heater pipes in the room where the set is. This is not always the case, and it may be necessary to run a ground wire through the window or wall and straight down to water pipes in the cellar, or to large metal plates buried in moist ground. In any case make the ground wire as short as possible.

In bringing aerial and ground wires to the receiving set, do not run them parallel to each other for more than a few feet at most, and keep them at least a foot apart even then.

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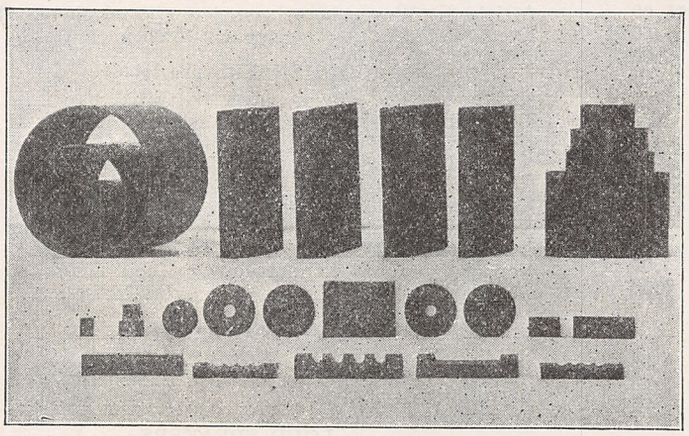

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the antenna lead-in to a protective device which is a combination of safety gap and fuse and then on to the receiving set, supporting the wire inside the house on insulators at least 5" from the wall. The ground wire also goes to the protective device and must be outside the building—not connected inside to water pipes, etc. The usual low receiving aerial does not "draw lightning," or create added danger from lightning, but is, in fact, a sort of protective lightning rod if properly installed, and these underwriters' rules are for the purpose of causing the installation to be a good lightning rod, if called upon to serve as one.

An antenna system installed in accordance with these notes will be a fairly good one, which can be improved upon only by the erection of masts of greater height than that ordinarily available on dwellings, trees, etc., and such an antenna system is suitable for the reception of amateur and broadcast radio signals.

The preceding chapters explain the erecting of a radio receiving antenna, which is necessary to bring it into tune with any transmitter which it is desired to hear. This is accomplished by adjusting the inductance (inertia) and capacity (elasticity) of the antenna circuit to proper values. A question might properly be asked, "What determines proper values of these quantities?" and an understanding of this is important. A circuit is in tune when the inertia effect exactly equals the elasticity effect. Now the amount of inertia effect present in a coil of wire, called an inductor, and the amount of elasticity effect present in a condenser, are different for different frequencies of alternating currents flowing through them. A certain coil and a certain condenser will have equal inertia and elasticity on one certain frequency of alternating current and not on any other frequency. The reasons for this are rather abstruse, and for an understanding of tuning it is necessary to remember only the following points:

1. Inductance and capacity have opposite effects on flow of alternating current.
2. Inductance and capacity effects must be made equal to tune a circuit.
3. When equal on one frequency (wavelength), they are unequal on all others, therefore, the circuit is tuned to that one wavelength and not to others.

One way of describing the condition of exact tune is to say that the inductance and capacity neutralized each other on that wavelength. One might ask, why put them in the circuit at all, if they are going to neutralize each other? The answer is that we have to have them in order to tune the circuit to different wave-lengths from different transmitting stations. Also remember that they neutralize each other for one definite wavelength only, depending upon their sizes, and, therefore, let current from that wave-length through, but for all other wave-lengths they do not neutralize, and, therefore, are out of tune and offer opposition to current of the other wave-length. This results in a receiving station hearing loudest the sending station it is tuned to. Finally remember that in the whole antenna circuit part of the inductance of the system is in the adjustable coil provided in the receiving apparatus and part is in the aerial wire and ground, where it cannot be adjusted; and the same with the capacity, part is in the apparatus and part in the aerial wire and the ground.

Now we should consider some of the actual, practical forms of making inductors and condensers. An inductor is simply a coil of wire, and to be an adjustable or variable inductor is provided with some means for varying the number of turns of the coil which is to be used. The simplest way is by use of a switch, see Fig. 1. This of course is adjustable in steps of so many turns on each point of the switch. Another way is a sliding contact touching the wire which is wound on a tube, see Fig. 2. This makes it possible to adjust the inductor, turn by turn.

Other ways vary the inductance effect of

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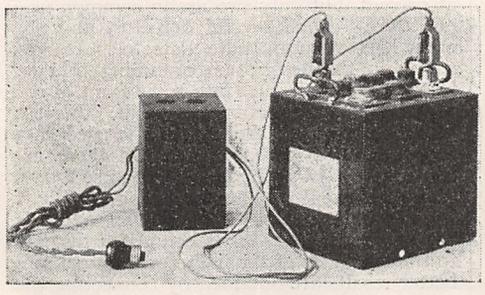

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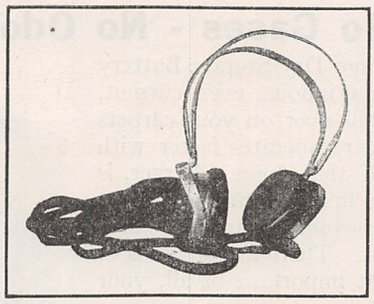

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the coil without changing the actual turns of wire. One is to move a copper plate near the coil, see Fig. 3. The copper plate changes the inductance effect of the coil; it lessens it more as it moves nearer to the coil.

Another way is to wind the coil in two parts, on two tubes, one of which is smaller and is placed inside the other and can be turned with respect to it, see Fig. 4. The inductance effect is maximum when the two coils, which are connected together in series, have their turns running the same way, and is minimum when the moving coil is turned 180 degrees. Figs. 3 and 4 are called continuously variable conductors, in distinction to Fig. 1, which is variable by steps of several turns each.

All four of these methods of obtaining variable inductors are used in various designs of present day Radio apparatus. It is important to efficiency that the resistance of Radio coils be low, so that, although the currents in receiving apparatus are exceedingly small, the wire used for tuning coils should not be too small. Copper wire of sizes No. 22 to 28 is usually used. In special cases stranded cable is used, with each strand separately insulated, to obtain minimum resistance. All connections have to make good contact because the voltages and currents are so small. Of course it is not always necessary or desirable to have both variable inductors and variable condensers. It may be sufficient to have one of them fixed, with no means for changing it. Then the other one must be variable. A fixed inductance is simply wire wound on a tube and the two ends brought out for connections.

Now let us consider condensers. Condensers have metal plates, half of which are connected to one side of the circuit, and half to the other side, with the two halves interleaved with each other, but not touching each other. If the two sides of a condenser touch, it is short-circuited and will not operate. The two sets of plates are separated by air, mica, paper or other suitable insulator. In most receiving devices air and mica are used for reasons having to do with efficiency of operation. A fixed mica condenser is represented in Fig. 5. As actually made, the plates and mica are clamped tightly together to form a rigid block, and the copper plates sticking out of one end form one terminal of the condenser, and the plates on the other end form the other terminal.

A variable condenser, as used in present day Radio apparatus, is made usually by fastening several metal plates together solidly on a base, the plates being separated a distance from each other by a small fraction of an inch, and arranging several other plates, which are fastened together, so that they can be turned with a handle in suitable bearings between the fixed plates, without touching them. This method is represented in Fig. 6.

So far we have considered tuning the circuit to obtain the maximum of current from the particular signals which are to be received. It now remains to be studied how the received current, which is a very high frequency current, is converted by means of a detector into low frequency current, which will operate telephone receivers and produce sound.

THE DETECTOR

There are several kinds of detectors known at present, but only two are in common use: one the so-called crystal detector, and the other the vacuum tube detector. It was shown in the description of tuning that an inductor—wire wound into some form of coil—was used in the antenna circuit. Besides its use for tuning, the inductor is used as a connection for the detector, and there are two ways of doing this in common use today. These two are shown in Figs. 1 and 2. Fig. 1 shows a "single circuit" connection. In this the detector apparatus is connected directly to the terminals of the inductor. Sometimes better results are obtained by connecting the detector across part of the coil instead of across all of it. The best fraction of the

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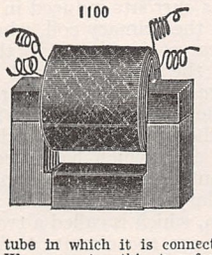

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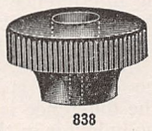

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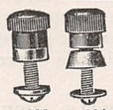

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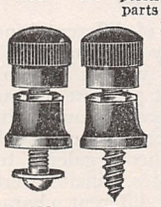
These are our very own patterns, from our own designs and look mighty handsome on any instrument. The top knobs are of composition, the bottom parts brass nickel plated polish.



650 651

No. 202 is nickel plated at bottom part.

"Rasco" Binding Post, 8/32 thread, each, $0.10; doz., $1.00.

No. 202, Post, each, ...$0.08

Nos. 650 and **651** made entirely in composition with a hexagonal brass nut in center.

No. 650 has 8/32 machine screw.

No. 651 has bottom wood screw.

No. 650, Post, each.....$0.08

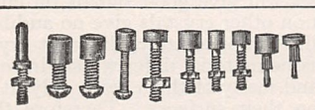
No. 651, Post, each.....$0.08

Dozen, each style.....$0.90

BRASS NICKEL POSTS

No. 029, Binding Post, each.....$0.05

No. 030, Binding Post, each.....$0.04



75 1 2 3 4 5 6 7 77 76

RASCO SWITCH POINTS

Nickel plated and polished. The following have been found the most popular.

No. 1 ¼"x¼", 6/32 thread, ea., $0.03; doz., 35c

No. 2, 3/16" high, ¼" dia., 6/32 thread, ea., $0.03; doz., 35c.

No. 3, 3/16" x 3/16", 4-36 thread, ea., $0.03; doz., 35c.

No. 4, ¼" dia.; ⅛" thick; stem 6/32, ea., $0.03½; doz., 40c.

No. 5, ¼" dia., 3/16" thick; stem 4-36, ea., $0.03½; doz., 40c

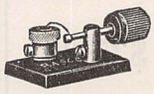
No. 6, 3/16" dia.; 3/16" thick; stem 4-36, ea., $0.03½; doz., 40c.

No. 7, 3/16" dia.; ⅛" thick; stem 4-36, ea., $0.03½; doz., 40c.

No. 75, Switch Stop, ⅞" long, 4-36 thread, complete with nut, ea., $0.05; doz., 50c.

No. 76, New style Switch Point, to be pressed into bakelite panels with forced fit. Wire is soldered to pin end. Head ¼"; dia., 1/16" thick, ea., $0.03½; doz., 40c.

No. 77, same as above, but head is ¼" dia. x 3/16" thick, ea., $0.03½, doz., 40c.



1898

THE RASCO BABY DETECTOR

In presenting this little Detector, we feel sure that it fills a place never taken before by any small detector. It does a variety of things and does them all well and better than many $5.00 detectors. The base is solid, black composition. Mounted on same is a nickel holder and binding post which holds a flutted hard rubber knob with its sliding rod member.

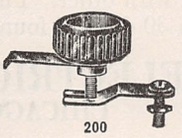
The outstanding part of the Detector, is the patented nickel detector cup and binding post. The knurled cap unscrews and you place the Galena Crystal in the cup, then replace the knurled cap and the galena crystal is held secure. The circular hole in the cap exposes enough of the crystal for ordinary purposes.

No. 1898, Rasco Baby Galena Detector. Price, prepaid $0.50

No. 1899, Rasco Baby Detector with Galena and Radiocite Crystals. Price, prepaid.....$0.75

PANEL SWITCH LEVER

New style switch lever with lock fork. It is impossible for this lever not to make positive contact at all times. The blade radius is 1¼". Blade is nickel plated and polished. Fork is phosphor bronze. The lock fork holds the screw (in which it rotates), securely. A loose contact is impossible.



200

No. 200, Switch Lever, complete as illustrated..$0.30

LITZ WIRE

323

This wire is recognized as the only thing for winding coils for Radio instruments. Particularly recommended with our **No. 343** Variocoupler Rotor, for vario-couplers, banked windings, etc.

No. 323, Litz Wire, 20 No. 38 strands, enameled double silk wire, per foot, $0.02; per 100 feet, $1.15

No. 890, Litz Wire, 10 strands No. 38 wire, per foot, $0.01; per 100 feet, $0.75.

No. 891, Litz Wire, 16 cables of three strands No. 38 wire, per foot, $0.03; per 100 feet, $2.25.

NOTE: This page contains only a few of our 300 specialties.

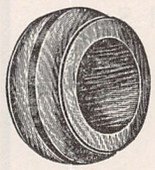
PANEL KNOB

This is a very distinctive knob and can be used on dials, panels, switches, condensers, etc. It is exceptional and well made. Dia. 1 1/16"; height 11/16"; comes with 8/32" bushing.

No. 815, Knob, each.....$0.18

815

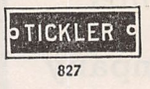
VARIOCOUPLER ROTOR



343

This rotor is used by all up-to-date amateurs. Is accurately turned of hard wood and is used as a secondary coil. It takes any finish, either shellac or stain and can be drilled readily for any size hole. Large hole 2" dia. Width of spool is 2". Total dia. 3⅝".

No. 343 Variocoupler Rotor, each $0.75



827

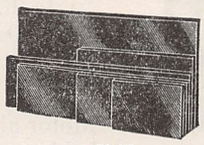
"RASCO" NAME PLATES

Our name plates are of brass with a black background. Letters are polished nickel. Order by name and number.

839

	Each		Each
807 "Phones"	$0.05	810 "Ground"	$0.05
809 "Aerial"	$0.05	812 "Primary"	$0.05
811 "Secondary"	$0.05	814 "Detector"	$0.05
813 "Audion"	$0.05	866 "On"	$0.05
865 "Off"	$0.05	840 "Increase Current" (Left)	$0.10
839 "Increase Current (Right)	$0.10	834 "Series"	$0.05
813 "Vacuum Tube"	$0.05	830 "Receive"	$0.05
831 "Transmit	$0.05	820 "2nd Step"	$0.05
821 "3rd Step"	$0.05	827 "Tickler"	$0.05
819 "1st Step"	$0.05	825 "Plate Variometer"	$0.05
826 "Grid Variometer"	0.05	835 "B Battery"	$0.05
823 "Secondary"	$0.05	817 "Output"	$0.05
836 "A Battery"	$0.05	824 "Primary Condenser"	$0.05
818 "Input"	$0.05	828 "Parallel"	$0.05
829 "Telephone"	$0.05	837 "+ —"	$0.05
833 "Detector Tube"	$0.05	841 "(Blank)" (takes pen or pencil writing)	$0.05
822 "Coupling"	$0.05		
808 "Load'g Coil	$0.05		

Price of all of our name plates in dozen lots, 50c, with the exception of the two "Increase Current"



350-55

BAKELITE PANELS

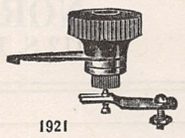
We list below six panels, the sizes of which have been selected after carefully checking up many dimensions of the most popular radio apparatus on the market.

Note particularly that our prices are anywhere from 25 to 50% lower than those quoted by most other concerns. The reason is that we buy these panels in very large quantities, **and we do not cut sheets to order.** Remember always that when sheets are cut to order they cost you at least 50% more than our prices, because **you must pay for the cutting and the necessary waste.**

Note also that we ship these panels prepaid. This alone amounts to a considerable saving.

No. 350	6"	x 12"	x 3/16"	thick,	each	$1.90
No. 351	6"	x 18"	x 3/16"	"	"	2.85
No. 352	9"	x 12"	x 3/16"	"	"	3.00
No. 353	12"	x 18"	x 3/16"	"	"	5.65
No. 354	6½"	x 19½"	x 3/16"	"	"	3.50
No. 355	6"	x 7½"	x 3/16"	"	"	1.20

"RASCO" LUBRICATED PANEL SWITCH

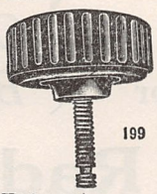


1921

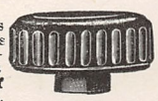
A radio switch that has two nuts at the end is a monstrosity, for the reason that it will never stay put. Our patent spring fork holds the switch handle always under uniform tension, at the same time it insures the best contact possible. **New wiping contact**, which covers every point of the switch point. Another new improvement is the lock fork, which can assume three different positions to accommodate the switch to various thicknesses of panels.

No. 1921 "Rasco" Switch, as illustrated, each **$0.50.**

KNOBS



199



4451

These knobs are favorites with all experimenters The size of both is: dia. 1⅛", height ⅝". No. 4451 comes with 8/32 and 10/32 bushing.

No. 4451, Knob, each...$0.06

No. 199 (screw length ⅝") Knob, each $0.10

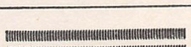
NAVY KEY KNOB

748

This navy key knob is now used on all standard wireless keys. It gives the right swinging mation and rests the fingers. It is a favorite with all advanced amateurs. Once used always used. The screw is 8/32 and will fit all keys.

No. 748, Key Knob, each.....$0.28

THREADED BRASS ROD



8032

We carry two styles, 6/32 and 8/32 thread. **Only 6" lengths sold. No others.**

No. 8032, Threaded Brass Rod 8/32 thread, per 6" length $0.08

No. 6032, Threaded Brass Rod, 6/32 thread, per 6" length $0.06

THE "RASCO" CATALOG

CONTAINS 50 VACUUM TUBE HOOK-UPS

Complete hook-ups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few, —The V.T. as a detector and one-step amplifier; regenerative circuit; De Forest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier, inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; etc., etc. The catalog contains 200 illustrations. On account of its great cost, it cannot be distributed free of charge. Mailed only upon receipt of

The catalog contains 200 illustrations. On account of its great cost, it cannot be distributed free of charge. Mailed only upon receipt of

15c in stamps or coin.

Radio Specialty Co.

This business was originated with the sole purpose to cater to the amateur who has small orders. ALL OF OUR ORDERS ARE SMALL and that is why your small order will never be sidetracked by us. A trial order will make you a life customer. Order from the above illustrations. "We can only stick you once." Try us with a 50c order. ALL GOODS PREPAID.

DEALERS

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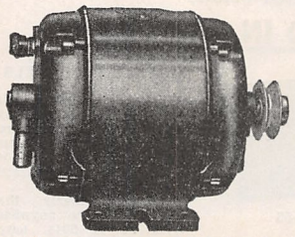
96-98 PARK PLACE, NEW YORK CITY

Factories Brooklyn, N Y.—Elkridge, Md.

Big Bargains in Motors and Radio Motor-Generator Charging and Transmitting Sets



We offer immediate shipment on ¼ h. p. Motor and Generator Set, 110 volt, 60 cycle, for charging "A" Batteries..... **$35.00**

¼ h. p. A. C., 110 volt, 60 cycle, Motor alone (like cut) for household purposes..... **13.50**

⅛ h. p. 110 volt, 60 cycle, A. C. Synchronous Motors, for operating spark gap..... **20.00**

½ h. p., 110 or 220 volt, 60 cycle, A. C. Combined Motor Generator Set with low voltage for charging "A" Battery and 500 volts for broadcasting..... **100.00**

Prices are f. o. b. Chicago. Send cash with order. Purchase price will be refunded upon return of goods within 30 days if found unsatisfactory.

NORTHWESTERN ELECTRIC CO.
412 S. Hoynse Avenue CHICAGO, ILL.

IF IT'S { *NEW* *ORIGINAL* *BETTER* or

Mazda Radio Makes It

Variable Condensers
2,000, 3,000, and 4,000 Ohm Head Sets
Amplifying Transformers
Jacks
Plugs
Carbon Rheostats
Binding Posts and Screws
Contact Points
Switch Points

and other necessary accessories

Absolute Guarantee of Quality. Very Attractive Prices

The Mazda Radio Manufacturing Company
1830-40 East 35th Street :-: Cleveland, Ohio

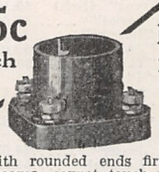
A BIG IMPROVEMENT IN SLIDERS

Replacing ordinary Rod and Slider
No Cutting—No Drilling—For any length coil
Adjustable to most sensitive spot on coil

COMPLETE, 30c

Martian Mfg. Co., 171 Washington St., Newark, N. J.

75c each



KELLOG V-T SOCKET
The Durable Socket

Kellog molded lamp sockets fit all standard four-prong based vacuum tubes. Extra heavy solid base 7/16 inches thick. Four German silver springs with rounded ends firmly held in position in deep grooves, cannot touch mounting surface. Double end nickel-plated binding posts. Connections can be made under the socket as well as above. A practically indestructible construction. 75 cents each, postpaid.

COMPLETE RADIO EQUIPMENT

The item above is merely a sample of the excellent line of radio equipment that is handled by the Apex Radio Company, Inc. All orders for sockets or other standard equipment will be filled the day received. Send 2-cent stamp for our new price bulletin.

APEX RADIO CO., Inc. 1105 W. 69th Street, Chicago, Ill.

whole coil to use is from one-third to one-half of the coil.

The other way of connecting the detector to the antenna is not a direct one, and is shown in Fig. 2. In this method the antenna circuit inductor is one winding of a transformer, whose other winding, called the secondary, is connected to a condenser. This transformer is often called a coupler, loose coupler, or variocoupler. It is a coupler in the sense that it couples together electrically the antenna circuit and the secondary circuit. The secondary coil has currents induced in it by currents flowing in the primary coil, when the two are placed near each other. In the usual Radio coupler the secondary coil is made movable with respect to the primary, so that the effect of the primary on it can be regulated. Now all the principles and rules of tuning, resonance, etc., which have been described for the antenna circuit, apply equally to the secondary circuit, so that in this type of connection, which is called a two-circuit receiver, there are *two* circuits to be tuned to the wave-length to be received instead of one, and also the coupling between the two circuits has to be adjusted for best results. It is obvious that the one-circuit receiver is very much more easily adjusted than the two-circuit. The two-circuit receiver, on the other hand, is more selective that is, when it is tuned to one certain wave-length, currents of other wave-lengths get through it to the detector less than they do on a single circuit receiver. The two-circuit receiver is, therefore, more useful in eliminating interference from undesired signals, and the single circuit receiver is advantageous in its simplicity of tuning operation.

In either the one- or two-circuit receiver the detector is connected to an inductor. The difference is merely that in one it is to the inductor in the antenna, and in the other to the one in the secondary. So that whenever currents flow in the inductor, the voltage which is present across it is applied to the detector.

The simplest way of connecting the detector and telephone receivers to the inductor is shown in Fig. 3. This does not work as well as Fig. 4, but will serve to explain the operation of the crystal detector.

CHARACTERISTICS OF MINERALS USED FOR DETECTORS

There is a large number of different kinds of crystal detectors. They all consist of a small piece of some one of various minerals, upon which rests with light pressure a sharp metal point or a small piece of some other mineral. Some of the minerals which may be used are: carborundum, silicon, galena, tellurium, molybdenum, pyrites, zincite, cerusite, etc. All these have different characteristics of operation, some being more sensitive than others, that is, they will make louder sounds in the telephones. In fact, some crystals will give good signals on currents which on other crystals give no audible sound at all. Unfortunately, different crystals of the same material differ widely in sensitiveness, and many of them work only at a few spots on their surfaces. Therefore the sensitive spots on any crystal have to be found by trial, and when found, do not remain in the sensitive condition indefinitely, but frequently require readjustment. Galena, with a fine copper or steel wire point resting very lightly upon it, is the most sensitive detector, but is also very unstable; strong signals, or slight mechanical vibrations, easily destroy its adjustment, and it has to be readjusted very frequently. Carborundum with a steel needle point resting upon it is one of the most stable crystal detectors, but is not very sensitive, unless a battery of the right voltage is connected across it. Many of the crystals operate better with a battery so connected, but this of course adds to the complication of the apparatus and loses some of the great advantage of crystal detectors, their extreme simplicity. In between these two, galena and carborundum, there are all degrees of sen-

(*Continued on page* 144)

Simultaneous Multiple-Wave Broadcasting Soon

Within a few months it will probably be possible for a representative of the Government to talk to anyone in the world, or to all people at one time, on the new Naval radiophone transmitting set at NAA, the Arlington Station on the Potomac. This statement was made by a high-ranking officer of the Navy Department today, who said that the Navy could now send code messages practically around the world by the use of relays.

Speaking into any ordinary telephone in Washington connected with the Arlington Broadcasting Station, an official could talk to a Pacific Coast station, which would automatically relay the message within a sixtieth of a second to Pearl Harbor, thence to Guam and Cavite, where the message would arrive only ¼ of a second after it left Washington. The further routing he did not explain, but it is known that other big stations are in prospect overseas.

The simultaneous broadcasting of a single spoken message from two stations on different wave-lengths was successfully conducted for the first time by the Navy on Saturday, for the purpose of making sure that plans for broadcasting the headquarters dedication program of the National Woman's Party were satisfactory. Through the cooperation of the American Telephone and Telegraph Co., direct wires were strung from the Woman's Party Headquarters to the Naval Air Station at Anacostia and the Naval Radio Station at Arlington. Test messages spoken at the Headquarters were transmitted by wire to these stations and put on the radio broadcasting circuits. At Anacostia, NOF, a 412-meter wave was used, with about 13 amperes radiation, and at Arlington, NAA, on a 2650-meter wave, with 40 amperes.

The system worked perfectly, serving two classes of receiving stations at once, the 412-meter wave furnishing many amateur stations within from 400 to 700 miles, while the long wave served stations equipped with larger receiving sets, between 800 and 1,500 miles distant.

The actual broadcasting of the speeches Sunday afternoon, however, was prohibited by naval officials Saturday, on the ground that the meeting was of a political nature such as previously ruled against by Secretary Denby.

The experiments in simultaneous broadcasting from two stations on different wave-lengths have been so successful that it is believed that several stations, not too greatly separated, will soon be able to broadcast a single phone message on a number of different wave-lengths at one time, reaching receiving stations near by and at great distances, even crossing oceans to powerful foreign stations.

With the perfection of this system and the necessary apparatus, the President, for example, could address practically the whole world, or at least all the people provided with suitable receiving apparatus, who understand English. This would furnish an excellent method of issuing official verbal statements of serious import or bearing on the policies of the country. The broadcasting of a direct personal message such as President Wilson made to Congress on the day we declared war, would have made America's position immediately known to the world. It is unlikely that any international broadcasts will be sent out by the naval stations except experimentally or in the event of a declaration of vital National importance.

THROUGH THE LOUD TALKER

Father: "This static comes in like Babe Ruth and a home run."

Mother: "It reminds me of a rush on a bargain counter."

Son: "Yes, sounds like some night when dad comes home late."

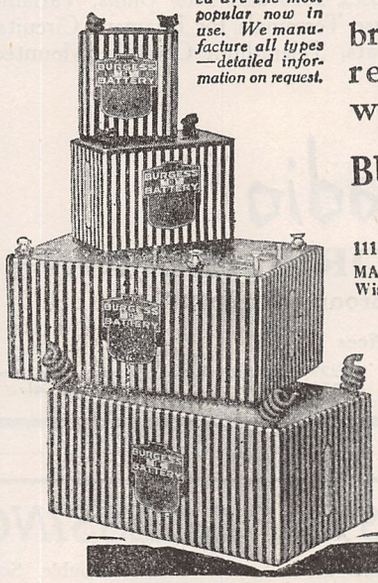
By A. J. DE LONG.

BURGESS
"B" BATTERIES

BURGESS "B" Batteries assure clear receiving, increase the efficiency of any receiving set, and they are cheapest in hours of service.

BURGESS "B" Batteries are sold by every progressive Radio Dealer and Jobber. "Look for the Black and White Stripes."

A postal card from you brings full information by return mail. Why not write to us today? (Dept. C)



The BURGESS "B" batteries illustrated are the most popular now in use. We manufacture all types —detailed information on request.

BURGESS BATTERY CO.

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"ASK ANY RADIO ENGINEER"

Immediate Shipment

"CLAPP-EASTHAM SETS"

Type H. R. Regenerative Receiver $40.00
Type H. Z. Two-stage Amplifier 40.00

"WHITALL MOULDED RADIO ACCESSORIES"

No.			No.		
306	3⅞-inch Dials ¼ or 3/16	$1.45	94	Nickel Plated Binding Posts	$0.10
307	3¼-inch Dials ¼ or 3/16	1.00	95	Nickel Plated Binding Posts	.12
308	2½-inch Dials ¼ or 3/16	.90	666	Switch Points 3/16 x ⅛	.03 ea.
765	Rotor 3 11/16-inch for Variometer	.75	667	Switch Points ¼ x ¼	.03 ea.
706	V. T. Socket with Binding Post	1 00	668	Switch Points ¼ x ⅛	.03 ea.
707	V. T. Socket "Our Leader"	.75	669	Switch Stops	.04 ea.
90	Moulded Top Binding Post, small	.08	670	Switch Stops	.04 ea.
91	Moulded Top Binding Post, med.	.10		Varnished Tubing, per foot	.10
92	Moulded Top Binding Post, large	.10		Brach Lightning Arrester, outside type	3.00
93	Moulded Top Binding Post, large	.12		Brach Lightning Arrester, inside type	2.50

THE NEW RADIO CALL BOOK JUST OUT, $1.00

Our new catalogue is now ready. It contains valuable information for the amateur. Diagrams of receiving sets, etc. *Write for it now, it is free.*

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THE WHITALL RADIO CO.

SPRINGFIELD, MASS.

Teleradio

(*Trade Mark*)

WIRELESS APPARATUS *of* QUALITY *and* EFFICIENCY

Manufacturers of

Crystal Receiving Sets, Fixed Telephone Condensers, Fixed Grid Condensers, Grid Leak and Condensers, Double Head Sets, 2000 and 3000 Ohms, Variable Condensers, 23 and 43 Plates, Mounted Fuse Terminals for Filament Circuits, Lightning Arresters, V. T. Sockets, Rheostats, Teleradium Crystals, Mounted Crystal Detectors.

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Our Radio Department is conducted by electrical engineers, which assure you dependable and highly efficient Radio equipment, either in complete sets or separate units, such as Head Receivers, Variocouplers, Variometers, Cabinets, Detectors, Antennas, Rotary Spark Gaps, Sliders, Panels, Dials, Knobs, Condensers, Grid Leaks, Contacts, Galena Crystals, etc.

We especially recommend our popular Receiving Set, RESODON, which is one of the most desirable outfits for the home, club, etc. This set comes in a beautiful mahogany finished cabinet. Write for literature.

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STOP GUESSING

Use the Pignolet Radio Double Scale Voltmeter and know at all times the voltage on your filament and plate and the condition of both your "A" and "B" Batteries.

Send for our booklet on testing and adjusting your set

Pignolet Instrument Company, Inc.

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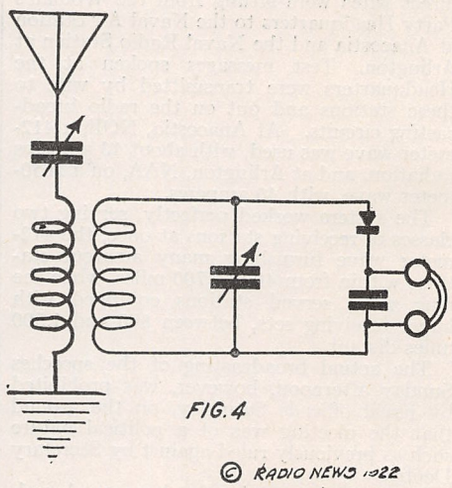
NEW YORK CITY

sitiveness and stability, and it is usually best to select a crystal which combines a fair share of both sensitiveness and stability. Silicon with a brass point is such a combination.

To explain how the crystal detector works: Refer to Fig. 3. The action of all of the crystal combinations above described is merely that of a rectifier; that is, current can flow through the detector in one direction only, so that when alternating current, which flows in two directions alternately, is applied to it, the current flow in one direction gets through the detector, and the flow in the other direction does not. This, in effect, changes the alternating current to direct current. Of course this direct current is a pulsating one, because no current is flowing during the time that the alternating current is applied in the wrong direction to get through, but the effect is the same. This pulsating direct current flows through the telephones as well as the detector, since they are connected in series, and this operates the telephones. In Radio telephony the alternating current which is received in the tuning elements, is varying rapidly up and down in strength just as the transmitter currents vary in accordance with the speech or music sound vibrations. And the pulsating direct current which results through the detector and telephones varies the same way, and, therefore, the telephone receiver diaphragms are pulled back and forth by the magnetic effects of the currents in their windings, and so give off sound waves.



Connections of a Crystal Receiver In Which a Loose Coupler and Two Variable Condensers Are Used

It is not known just how or why the crystal detector works as it does, and various explanations have been proposed, but it is definitely known that it acts, in effect, as a rectifier. Some crystals are more sensitive than others because they are better rectifiers. All crystals will work much better if they are mounted in a soft metal alloy, in order to get as much contact with them as possible. If the mineral is held in any other way, such as by set screws, or in a fuse clip, this makes in effect another metal point, working oppositely to the one which is provided, and then current cannot flow through the detector in either direction.

The connections shown in Fig. 3 are subject to improvement by the addition of another condenser, see Fig. 4, which is called the "telephone" condenser, or sometimes the "stopping" condenser. This should always be used. It need not be a variable condenser, as its size is not very critical. It is usually made of the type shown in Fig. 5 of the last article, with mica or paper insulation. It is used because it has the effect of accumulating and magnifying the rapid high frequency pulses of current which come through the detector into less frequent but larger pulses through the telephone receivers.

Only one item of the crystal detector set remains—the telephone receivers. The ordinary wire telephone receivers, such as used in desk sets, are not well suited to this use,

because the windings are not adapted to work efficiently in this sort of a circuit. Special windings, known as high resistance windings, are necessary for good results, and so most radio receiver head-sets are of this type.

In summary, the crystal detector set is ideal where simplicity of apparatus is desired, and where the distance to be worked is not too great. The distance which a crystal detector receiver will cover is of course dependent upon the power of the transmitting station. The present commercial broadcasting radio telephone stations can be heard on a crystal detector receiver at distances of usually not over 50 miles. For greater distances than this, the more sensitive vacuum tube detector must be used. This will be the subject of another article.

"---And It Came to Pass"

(*Continued from page* 48)

shaved for many years. For lo, he is a state of mind rather than an age, and a hinderance rather than a help.

He hangeth around after meetings, and delighteth to send out mangled Continental on the buzzer practice-set. He thinketh that all listen unto him, and that he is cute.

Confuseth him not with the lad who may be only eight, yet who has the real stuff in him. For there are kids and kids, and some are good and some are not, yet it taketh all kinds to maketh up a club, and should members getteth together and describeth their President, *Radio News* would have to run in the story on an asbestos insert.

But the President delighteth in the fact that they know him not, yet should they seek him out, he desireth to state that these types are not from any one club, but from several whereof he hath been a member, and that they are not any one individual, but several. And he hopeth exceedingly that all will understand—for doth not the time appointed for the Election of Officers draw near?

Selah!

Broadcasting by Wired Wireless

(*Continued from page* 35)

RECEIVING WITHOUT AERIALS AND BATTERIES

It is believed by experts that one of the most practical improvements will come in the very near future, by which the broadcasting service, whether from a distance or upon the wires themselves, will utilize in the receivers the electrical energy necessary to operate these receivers, taken directly from the same plug in the lighting circuit. The principal drawback in operating receiving sets at present is the necessity for purchasing batteries in large numbers and keeping them charged continually. This is not only a great source of initial expense, but a source of continual upkeep.

Once the whole apparatus is condensed and operated directly from the lamp socket, and maintained indefinitely therefrom, we have reached the point where the installation of home sets on a practical basis can go ahead on a big scale.

MUSIC AND NEWS FROM DESK LAMP

In the office of the Chief Signal Officer, his receiving set now operates directly from the lamp socket on his desk both for receiving the local broadcasting of baseball, music, etc., and also for receiving the special programs which the Signal Corps station sends on the circuit itself. The connection with the socket

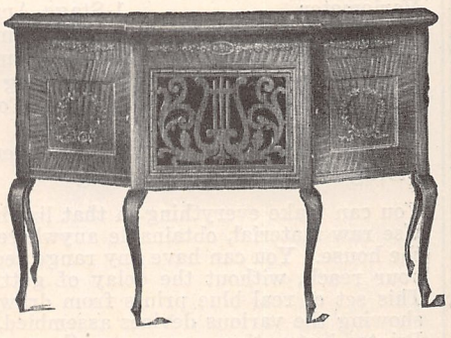
Install Your Radio Into One of These Beautiful Playerphone Cabinets by Simply Connecting Head Phones in Phonograph Horn

This splendid Console Cabinet prepared with compartment on side for your Radio Outfit, $100.00. With complete Phonograph Equipment, $25.00 to $50.00 extra.

This Exclusive Radio Phone Desk, made especially for Radio Sets, with phonograph horn ready for Radio connection, $50.00.

Playerphone
The QUALITY TALKING MACHINE

High Grade, Genuine Mahogany, Beautifully Finished Upright Cabinets from $50.00 to $150.00. Prepared with compartment underneath horn for your Radio Outfit. With complete Phonograph equipment, $25.00 to $50.00 extra.



This large magnificent White House Model Playerphone Cabinet, the very finest on the market, prepared with compartment on side for your Radio Outfit, $400.00. With complete phonograph equipment, $50.00 to $100.00 extra. Electric or spring motor.

If you do not already own a Radio set, order any of the above cabinets, and we can arrange to have installed one of these splendid Two-Step Radio Sets, like shown in Console model, for $100.00 extra, without tubes, batteries and head phones. We believe this set will equal and receive from as great a distance as any set on the market sold at twice the money. Write or wire for full particulars.

WILL PROCURE COMPLETE SET OF VACUUM TUBES, ONE DETECTOR AND TWO AMPLIFIERS

Excellent proposition for Agents and Dealers

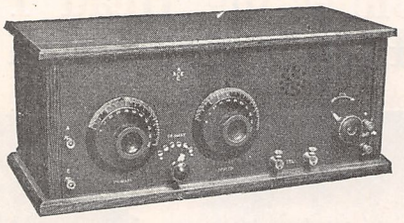
D. W. McKENZIE

Manufacturer of Playerphone Cabinets

McKenzie Bldg., 4223 West Lake St., Chicago

IF QUALITY COUNTS—

bear in mind that ACE equipment speaks for itself. An ACE Type TRU Radio Concert Receptor can be placed in your parlor, and is in a class with your piano or the finest phonograph.

$50  **$50**

Licensed under Armstrong Patent No. 1,113,149
Tested Vacuum Tube and B Battery furnished extra, $7.25

For electrical efficiency we claim our TRU Receptor to be equal or superior to any similar equipment now on the market.

A very important point to be considered when purchasing a concert receptor is the proposed change of wave-lengths of broadcasting stations. The majority of radio receivers now on the market would be worthless should this change be effected.

Our receiver is arranged for immediate adaption to this change by even a most inexperienced person.

Better investigate—we have literature for the asking

THE PRECISION EQUIPMENT COMPANY
2437 GILBERT AVENUE CINCINNATI, OHIO

Can You Use Anything in This List?

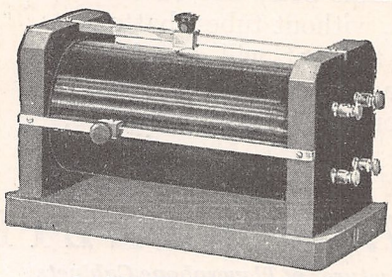
Loop Aerial	Knob	Jack
Flat Top Aerial	Dial	Duo-Lat. Coil Plug
Single Wire Aerial	Switch Lever	Triple Coil Mount
Cage Aerial	Switch Points	Duo-Lateral Coils
Umbrella Aerial	Rheostat	Phones
Variometer	1-Stage Amplifier	Loud Talker
Variocoupler	2-Stage Amplifier	Series Par. Sw.
Short Wave Receiver	3-Stage Amplifier	Anti-Cap. Sw.
Long Wave Receiver	Amplifying Trans.	Switch Stops
VT Detector Cabinet	Variable Condenser	Binding Posts
Tube Socket	Grid Leak	Short Wave Hookup
Storage Battery	Grid Condenser	Long Wave Hookup
Storage "B" Bat.	Plug	Loop Set Hookup
		Det. Cab. Hookup

You can make everything in that list if you follow our plans and instructions. Use raw material, obtainable anywhere, lots of it in your own shop or around the house. You can have any range receiver desired and at a price well within your reach, without the delay of getting finished parts from distant points. This set of real blue prints from drawings gives every detail of construction, showing the various devices assembled, also each component part individually. Printed instructions accompany them. You will save their cost on the Detector Cabinet alone.

The Biggest Value in Radio

Complete Set Blue Prints and Instructions, $3.00, Postpaid (No Stamps)

THE PLAN BUREAU, 1929 McCausland Ave., St. Louis, Mo.



LAMB TUNING COILS
Two nickel sliders and rods; four nickel binding posts. Coil contains about one-half lb. No. 22 enameled magnet wire. Mounted in hardwood ends and base. Price, $3.00.
F. JOS. LAMB COMPANY, 1960 Franklin St., DETROIT, MICH.

WOUND COILS
Wound With No. 20 Enamel Wire on our Black Treated Tubes.

3"x6"	$1.00	3"x8"	$1.25
4"x6"	1.10	3½"x9½"	2.50
3"x7"	1.10	3"x12"	2.00
		3½"x12"	$3.00

Postage Extra

Radiophone Station W-A-A-M

ASK FOR REEL EASY PRODUCTS

I. R. NELSON CO.
BOND ST., NEWARK, N. J.

is reduced to its lowest terms by the insertion of two small Dubilier condensers, which can be commercially purchased at 35 cents each and which are inclosed in a special plug to protect and guard against short-circuiting the light circuit itself, and at the same time to offer a free path for electro-magnetic waves of high frequency.

It is understood that a new device will soon be put on the market which will further perfect and simplify this means of connecting receiving sets with lighting systems.

FUTURE UP TO LIGHTING COMPANIES

Of course the electric light lines are the property of the lighting and power companies, and objection may be registered by these companies if their lines are used as antennæ for receiving without their permission, but in the event that they do, it is possible that they may themselves establish broadcasting stations and maintain entertainment and other programs for their subscribers at a fixed fee.

Radio Minerals

(*Continued from page 36*)

off as a gas and silicon remains as a silvery, metallic appearing substance, highly crystalline and very brittle.

A substance of little commercial value, but finding a restricted use as a detector, is tellurium. This is a rare mineral element producing small crystals hexagonal in shape. It is restricted principally to Colorado and Transylvania.

The non-metallic boron is never found free in nature although many of its compounds, such as borax and boric acid, are. The element is prepared by heating the chloride of boron in an atmosphere of hydrogen to a very high temperature. Pure boron is a dark grey solid which is almost as hard as a diamond. In this condition it has been used as a detector.

Arsenic has also been used for this purpose, although the crystals, which occur free in nature, are comparatively rare.

Far more important is the artificial silicide of carbon, carborundum. It is prepared like silicon, only more coke is employed, and the heating is continued for a longer period. The silicon, which is first formed by this action, enters into a reaction with the excess of carbon forming beautiful purplish black crystals of this substance. Carborundum is extremely hard and is an admirable abrasive. When used as a detector, it is advisable to employ a small constant potential across the terminals. This will materially increase its sensitiveness.

With the average crystal rectifier a light, perfect contact of the wire on the crystal or of crystal on crystal, gives the best results. When it is desired to mount such a crystal in a metal cup, care must be taken that it is not heated too excessively, as high temperatures, it has been found, cause them to lose their sensitiveness. Therefore, a low melting alloy such as Wood's metal, which will melt in boiling water or a similar low fusing solder, should be employed.

Gunbarrel Radio

(*Continued from page 47*)

"We rode to the mouth of Devil's Fork one morning early, and by the crack of day we had hidden our horses in the bushes and started dodging through the thickets of rhododendrons up the hollow. I sent the seven men who were with me up the first two creeks with instructions to swing around the benches in the mountains on each side toward the headwaters of the Fork. I took the main branch and followed a small path which looked as if it had been travelled to some extent.

The Result of 15 Years of Experience in Radio

Pacent *Standard* Jacks and Plugs

Although the Pacent Electric Company, Inc., was organized three years before broadcasting became popular, its president, Louis Gerard Pacent, has been identified with the radio industry for over fifteen years and every Pacent product has his extensive experience behind it. The **Pacent Universal Plug** and **Radio Jacks** were the first products of their kind on the market. They soon became the recognized standard.

Every Pacent product has service and convenience built into it; every item is designed and constructed with a thorough knowledge of the duty it is to perform. Pacent superiority is recognized by the leading radio manufacturers who use Pacent products as standard equipment. They are also distributed by the leading jobbers and dealers.

Pacent Universal Plug

PACENT UNIVERSAL PLUG
Cat. No. 50
List $1.25

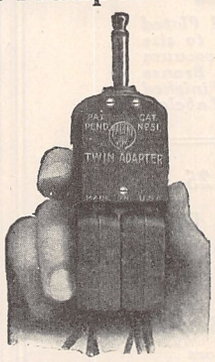
The Pacent Universal Plug was the first to make an appearance.

A telephone cord can be attached to it in a jiffy. The electrical connection established with the Pacent Plug is a perfect one.

The Pacent Plug is finished in velvet black with metal parts highly polished. It can be used with any standard jack, although it was made especially to fit the Pacent Jacks. It can be used not only in connection with 'phones, but with loud speakers, keys, Duo Lateral coils and microphones.

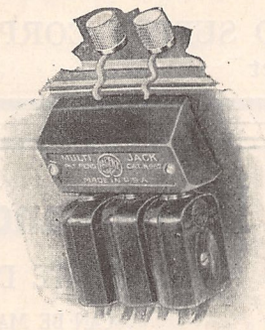
Pacent Twin-Adapter

How troublesome and unsatisfactory it is to pass one set of 'phones about so that more than one person can listen in. Oftentimes a receiving outfit is provided with only one jack and in such cases the Pacent Twin-Adapter will allow a single jack to accommodate two Pacent Universal Plugs. In this way two pairs of 'phones can be used or one pair of 'phones and a loud speaker. Thus the receiver can be tuned with the 'phones and the loud speaker can be plugged in later.



PACENT TWIN-ADAPTER
Cat. No. 52 List $1.50

Pacent Multi-Jack



PACENT MULTI-JACK
Cat. No. 51 List $1.50

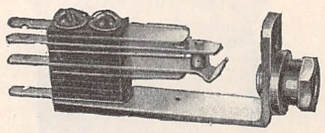
The Multi-jack, when screwed to the side of a receiving outfit will allow three sets of 'phones to be plugged in or two sets of 'phones and a loud speaker. It may also be screwed to the table or the testing board.

The Multi-jack is shaped in such a way that two or more of them can be placed end to end. All standard plugs can be used with the Multi-jack but, of course, the Pacent Plug is best.

Although the Multi-jack takes the place of three jacks, it sells for the price of one. Every radio experimenter will find a great number of uses for it.

Pacent Radio Jacks

The Pacent Radio Jack is a fit companion for the Pacent Universal Plug. In fact, one is not fully complete without the other, for they have both been designed especially for radio work and for each other in particular.



PACENT RADIO JACKS
Cat. Nos. 61-66 List .70-$1.20

All Pacent Radio Jacks are manufactured with booster springs, an additional spring which exerts a constant pressure on the other springs and this increases the life of the jacks. It also makes for jacks which are rugged, of positive action and of perfect mechanical construction. The liberal-sized contact points are made of pure silver which insures a perfect electrical connection.

RADIO ESSENTIALS

This term applying to all Pacent Products is significant because each product is a device indispensable to every radio user.

DON'T IMPROVISE—PACENTIZE

CONSUMERS—Your Dealer Will Gladly Supply You
JOBBERS and DEALERS — Send for Bulletins and Outline of Sales Plan

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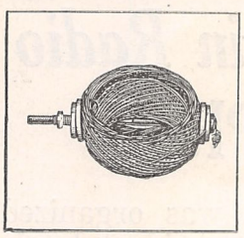
33 So. Clinton St. CHICAGO, ILL.
Bourse Building PHILA., PA.

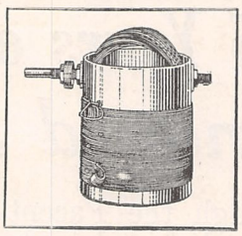
LOUIS GERARD PACENT, President

150 NASSAU STREET NEW YORK, N. Y.

Member Radio Section, Associated Manufacturers of Electrical Supplies



A Better Variometer



Estru Lattice Variometers and Variocouplers are small, compact instruments with no unnecessary framework, which makes them most easily wired.

Maximum efficiency by lumped inductance and low distributed capacity.

Sharp tuning. Ideal for portable sets and for those who assemble their own, because of easy accessibility.

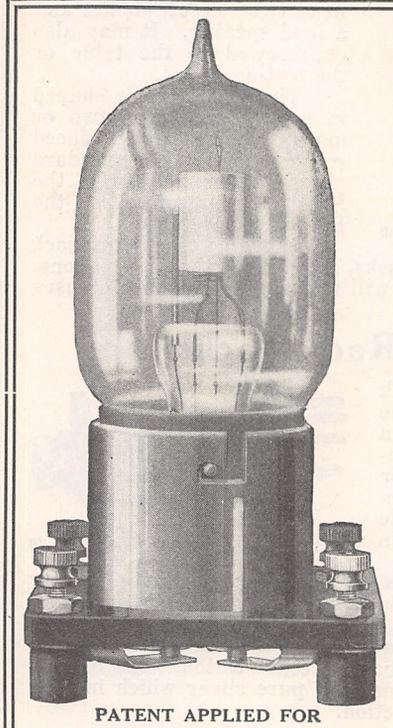
Immediate Delivery

Variometer - - $5.00
Variocoupler - - 4.50

Mail orders promptly filled

Dealers: Write for our proposition

NORTHERN RADIO SUPPLY CORPORATION
542 West Washington Street Chicago, Illinois



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Dealers and Jobbers

IMMEDIATE DELIVERIES

CAN BE MADE ON

THE ALAMO SOCKET

Specifications

Insulated Feet; Nickel Plated Barrel; Barrel Reamed to size insuring no vibration of vacuum tube; Large Phosphor Bronze Springs; Base Satin Finished Formica Properly Labeled.

List Price $1.25

UNUSUALLY ATTRACTIVE DISCOUNTS. WRITE OR WIRE FOR PROPOSITION.

The Alamo Sales Corp.
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134 E. Market Street Indianapolis, Ind.

Radio Frequency Transformers

Type RT-1, for the amateur and broadcasting range, 175-500 meters.
(Patent Pending.)

$6.00

Will work on all tubes.
"The only completely shielded iron core R. F. transformer"

RADIO SERVICE LABORATORIES

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National Distributors for Radio Service Laboratories, Inc.

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Experimenter Publishing Company, Inc. 53 Park Place, New York City

"Right then I ran into this 'Hilly-Billy' wireless I spoke about a few minutes ago. I reckon you might call it 'Gun Barrel' wireless because the messages were sent through a rifle barrel. The only disadvantage it had was the fact that it was forced to work in shorter—wave lengths? Is that what you call them?

"I was crawling through a particularly dense clump of bushes when suddenly I burst in the open. A boy of about fifteen was standing in the path before me. He stared for an instant as if he had seen an apparition. Then he wheeled and disappeared in the bushes before I could stop him. I followed him as quickly as I could, but he was gone and he made no noise as he whipped through the forest.

"I knew that I was close on a still somewhere and once or twice I thought I could detect the odor of fermenting 'mash' in the air. Just then I heard a strange sound far up the mountainside. It was more shrill and carrying than that made by a cornet, yet much the same. For an instant I was puzzled and stood listening intently. The sound came again and the echoes reverberated among the crags on the opposite mountain. Then I recognized it. Someone was simply blowing into a gun barrel with lips pursed like a trombone player. As a youngster I had done the same thing many times to call my dogs, when fox hunting.

"Immediately I realized that the boy I had seen was signalling a warning to his people. Somewhere in the distance another gun-barrel picked up the signal and relayed it on back into the hills. In five minutes I knew the entire countryside would be on its guard, so I quickened my footsteps in hopes of getting one capture before it was too late. I came to a trickling stream that ran down, out of the rocks above me. I was thirsty and stooped to get a drink. The sour taste of the water sent me scurrying to cover.

"Cautiously I made my way upward, careful that I didn't step on a stone that would turn, or a dried twig. Rounding a turn in the cliffs I saw a man bending over the creek. I stepped into the open and covered him. He obediently threw up his hands and waited for me to slip the handcuffs on him.

"He had heard the signal and had dismantled his still. He must have had a partner, for the liquor and the worm were gone. My prisoner had been trying to cool the boiler in the creek when I came upon him. The fire had been kicked out, but the vats and tubs of mash and 'beer' were still there. I punched the boiler full of holes with his axe and started back with my prisoner. To tell the truth I didn't want to stick around there any longer, because I didn't know what time that partner might take a pot shot at me from the bushes.

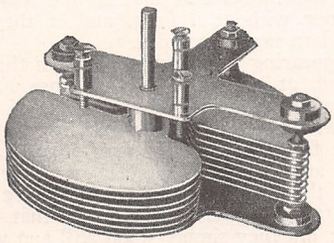
"Before I reached the creek bed again, that partner got busy with his wireless. He climbed to the top of one of those crags and started that weird mellow signal floating back to the haunts of the Farleys. At intervals of about two minutes he would blow one long and two short notes and then every third time he varied it by a different set of notes, sometimes several short ones with regular intervals.

"Soon he got a reply from a point a half mile away to the left and then another took it up somewhere back of us. Pretty soon the woods seemed to be full of those gun-barrels all tooting the same signal. It was uncanny and I began to jab my prisoner in the back with my gun to make him speed up. Those signals seemed to be closing in on us and by that time I was positive they were talking to each other with their wireless.

"My men were so far away, back down the creek and up the mountain sides that they couldn't reach me in time, even if they understood what all the tooting meant. It was a ticklish position and, I'll give you my word, I didn't have much idea of ever getting out with my prisoner or myself, either, for that

ARKAY Radio Products

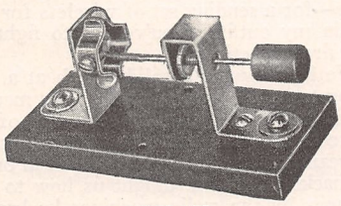
Indispensable to Your Wireless Equipment



ARKAY VARIABLE CONDENSERS

Arkay Variable Condensers increase the sensitivity of your tuning set; afford a delicate adjustment on low capacities and insure positive operation throughout the range; made with hard aluminum plates. Cannot warp.

15 Plate—.0005 Mfd. Capacity.....$5
29 Plate— .001 Mfd. Capacity.....$6



ARKAY CRYSTAL DETECTORS

A detector with universal adjustment, permitting the whole face of the crystal to be searched for sensitive spots. Cannot be jarred out of adjustment. Takes either mounted or unmounted crystals.

Price, $1

Arkay Loud-Speaker Radio Horn—$5.

The Arkay Horn fits any make of receiver, works on one or two stages of amplification, amplifies your signals, speech or broadcasted concerts without the slightest distortion. You get wonderful results through the Arkay.

Black enamel, $5. **Polished nickel, $6.**

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CANTON, OHIO
Wireless Mfg. Co.
DETROIT, MICH.
Grier Battery Supply Co.
INDIANAPOLIS, IND.
Hatfield Electric Co.
MILWAUKEE, WIS.
Kesselman-O'Driscoll Co.
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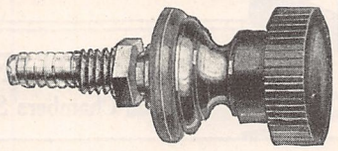
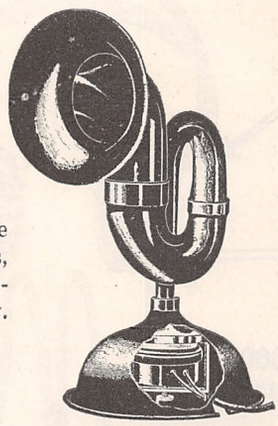
ARKAY VERNIER ADJUSTER

You can tune closer and sharper if you will attach this adjuster to your dials. Spring keeps the adjuster pressure constant.

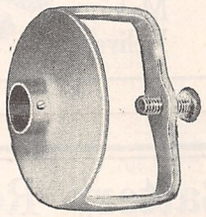
Price, $1





PHONOGRAPH ATTACHMENT

Fits perfectly in place of the sound box on the Victrola, Sonora or Columbia machines and reproduces and intensifies with absolutely no distortion of signals, speech or music. Fits any popular make of sensitive Radio Phone Receivers.



Made of cast aluminum. Light, bright, rigid; prevents vibrations and over tones.

Price, $1.50

Manufactured and Distributed by

Riley-Klotz Mfg. Co., Inc.

17-19 Mulberry Street, Newark, N. J.

Dealers Write for Proposition

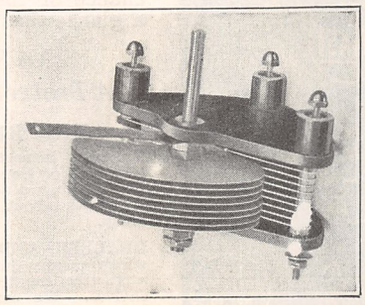
A Marshall Outfit
Variable Condenser

designed by expert radio engineers of long standing and made of best materials throughout.

Front and back plates of selected hard rubber. Central mandrel turns in brass bushing and is adjusted through one or more cone bearings. Plates and separators, of especially prepared aluminum, cannot get out of true.

ASSEMBLED CONDENSERS

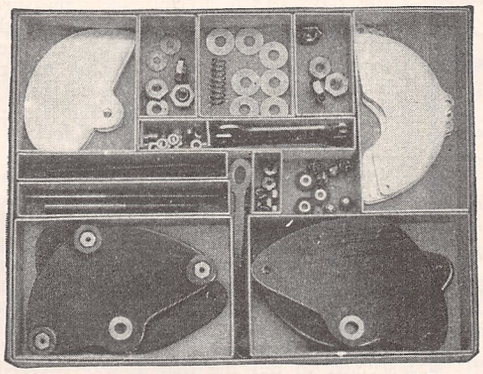
3 plates, capacity .00014	$2.50	17 plates, capacity .00061	$4.25
5 plates, capacity .00021	2.75	35 plates, capacity .00121	6.00
9 plates, capacity .00033	3.50	67 plates, capacity .0023	12.00



A .00061 MFDs Size

Here's a new idea
BUILD YOUR OWN CONDENSER

Save money. No technical experience necessary. Lots of fun! You may buy the Marshall Condenser in any standard capacity "knocked down" ready for assembling at prices materially lower. Complete instructions for assembling **any capacity** furnished with each outfit. Figure each inner plate element at .000067 MFDs.



Special Outfit Containing 2 Marshall Variable Condensers Ready for Assembling

READY TO BUILD

3 plates, capacity .00014	$1.90	17 plates, capacity .00061	$3.35
5 plates, capacity .00021	2.10	35 plates, capacity .00121	5.15
9 plates, capacity .00033	2.55	67 plates, capacity .0023	9.40

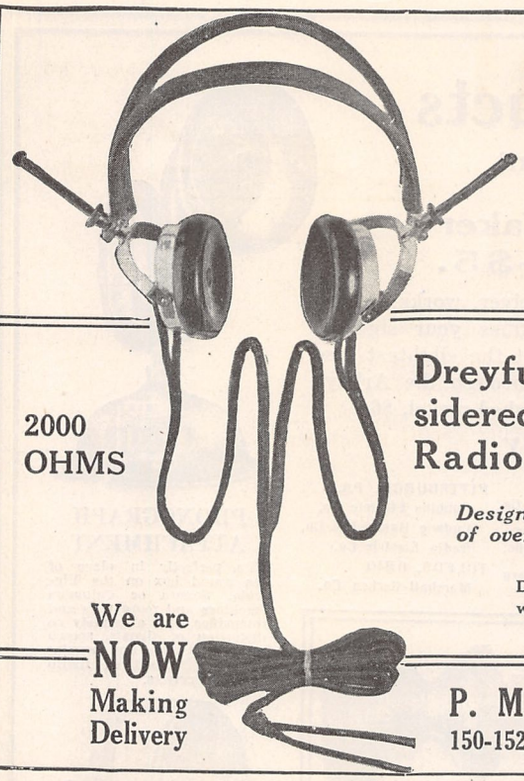
Marshall Condensers are very ruggedly built for C. W. work either sending or receiving.

Prices on other units or extra parts on application, with which you can build special units to give capacities needed to unify various non-standard antennae and receiving outfit units.

NOTE:—If your dealer cannot supply you write us direct enclosing $4.25 for a .00061 MFDs assembled condenser or $3.35 unassembled, together with dealer's name and address and the Marshall Condenser will be sent anywhere in the United States parcel post paid. Order at once.

Live Wire Retailers—Our new selling plan will interest you. Write. We do not want cash from responsible parties. To such our terms are net 30 days, or we will ship C. O. D. when no credit references are given. Discounts better than usual.

NEW HAVEN RADIO CO., Mfrs. **Chapel and Hamilton Sts., NEW HAVEN, CONN.**



DREYFUSS PHONES

(Concert type)

$8.00 Per Pair List Price

2000 OHMS

Dreyfuss Phones are considered the Best Phones for Radio Telephony work.

Designed by Telephony Engineers of over 18 years experience

Distributors:—Get in touch with us for open territories

We are NOW Making Delivery

P. M. DREYFUSS CO., Inc.
150-152 Chambers St. New York, N. Y.

Battery Readings Must Be Accurate

Don't Ruin Your Battery by Using Inaccurate BATTERY-TESTERS

Sold on a strict Guarantee.
Adopted by Leading Battery Manufacturers.
Price..... $1.25

The Read-Easy Chargometer is scientifically designed to be extremely accurate. The oval ball balanced float and the heavy tapered glass container eliminate all chance of the ball sticking to the sides. You see at a glance that it floats freely and is clear of the bottom.

No Spilling or Splashing of Acid
A Protection for Your Clothing and Rugs

THE READ-EASY INSURES ACCURACY

Frequent inspection is your only insurance against heavy repair bills, loss of time and against untold inconvenience. But a test tells you nothing unless your readings are absolutely accurate. Know the truth about your battery. Read-Easy will tell. Order yours today.

DEALERS AND JOBBERS, write at once for our proposition which means quick turn over and volume sales. We furnish an attractive counter display which moves our goods off the dealers' shelves. We can give immediate delivery now in quantity lots.

Read-Easy is a quality, precision product. Handle the best hydrometer and you'll sell the most.

ALA MANUFACTURING CO.
Radio Dept. No. 12
401 to 419 S. Sangamon Street Chicago, Ill.

RADIO OWNERS If your dealer can't supply you send $1.25 direct to us and we will send at once parcel post prepaid insured.

Dealers and Jobbers

Do you handle Variable Condenser Plates?
Also Variable Condensers, Quality Merchandise
Dealers—Place your orders with us for
"Signal" & "Federal" Apparatus

Write today!

The Dietze Radio Co.
30-32 Stirling St., Newark, N. J.

RADIO

Supplies and Sets in stock

EVERYTHING ready for immediate delivery, including the new

EVERETT PHONES

Eseco Catalog 50c by mail

ELECTRIC SERVICE ENGINEERING CO.
105 West 47th Street 14 Union Square, East
NEW YORK CITY

matter. He did everything he could to retard our progress and he succeeded mighty well. All the time, those horn- or gun-barrels seemed to be closing down on me. I don't know why they kept blowing after they all got their bearings, unless they wanted to keep in touch with each other. I rather believe that they figured on getting my nerve with the things and making me leave my prisoner without a fight, and if they did, they darn near succeeded.

"Appearing as if by magic from the very ground, at least a dozen of those Farleys suddenly confronted me. Each of them carried a rifle and those same barrels I had heard for an hour were now pointed at me with an intent I couldn't misunderstand. Why they didn't shoot I never have been able to figure out. They had that reputation, but they simply stood still and waited until my prisoner searched my pockets, found the key to the handcuffs and freed himself. When he joined them they melted away in the bushes and I breathed a sigh of relief.

"I didn't wait for the other boys where we had hitched the horses, but saddled up and beat it back to headquarters as quickly as I could. As soon as I arrived I sent Al. Lambert to the nearest city—Louisville, I believe it was—for a sending set of wireless for each man in my outfit. You've got to fight fire with fire sometimes.

"We lay low for a solid month at a little mining town fifty miles away. My men got jobs in the mines to allay suspicion of any chance friend or relative of the Farleys. In the meantime at nights we gathered in one of the shacks where Al. taught us how to send messages by the radio machines he brought back with him. They were small sets which we could carry in our saddle bags behind us when on the raids, and even with us when forced to leave our horses. We got so we could handle them enough to send out an S O S or something like that, but most of us were never able to get real chummy with them.

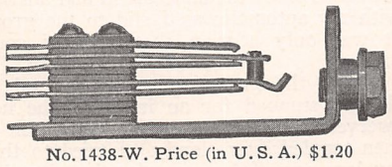
"After a month had passed, I figured that we could slip back into those mountains without being detected. Thirty days of waiting will throw almost anyone off his guard. We came back to our old headquarters again and Al. got ready to take all messages we might send in. He was to stay at headquarters with those men who were not on duty. They were our reserves to come to the assistance of any of us who might need it.

"We didn't dare go anywhere near the homes of the Farleys because they would be sure to see us, so we contented ourselves with the old tactics of searching, from under cover, whatever places looked likely to us. We began by combing the section where I had made my capture, but they had moved. We found where two or three stills had been running, but there was nothing there save dead ashes and rotting mash.

"Each man was working as a scout on his own hook and reporting each night when he came in. We worked some at night, but most of the searching had to be done during the day. As a precautionary measure the moonshiners would build their fires with dry white-oak wood which comes the nearest to giving off no smoke of any material I know. Consequently they were fully protected against discovery on that score.

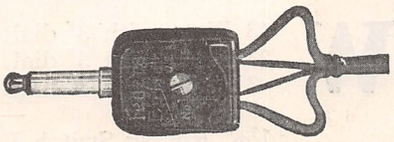
"One afternoon, about five o'clock, I rode along a little path that seemed to lead straight up against the cliffs. The woods were open and there was no water close, so I certainly wasn't expecting to run into anything there. My horse was picking his steps carefully when suddenly he stopped dead in his tracks and refused to budge an inch. I looked to see if a rattlesnake was in the path; he had halted because of snakes before. As I leaned forward, something seemed to tell me that I was covered. I simply rolled from the saddle intending to throw myself over the lower side of the road.

Federal
RADIO APPARATUS
Unexcelled in Efficiency and Durability



No. 1438-W. Price (in U. S. A.) $1.20

The FEDERAL automatic filament control jacks provide a convenient and rapid means for shifting the telephones from one stage to another. No. 1438-W is designed for use between the Detector and Amplifier and successive stages of amplification.



No. 15 Universal Plug. Price (in U. S. A.) $1.75

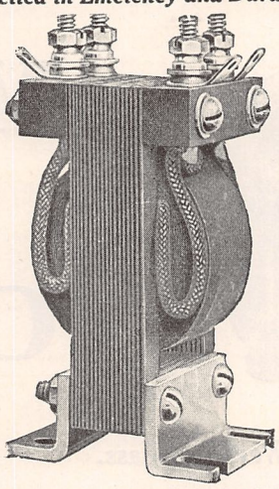
No. 15 Universal Plug is a radical departure from the ordinary telephone plug. Unlike others of similar design, spade terminals, pin connections, stranded or solid wire may be used without soldering.

FEDERAL HEAD TELEPHONES

Afford a comfortable, light-weight sensitive headset which will meet the most rigid requirements.

No. 53-W 2,200 ohm (in U. S. A.) $8.00 per set.

No. 52-W 3,200 ohm (in U. S. A.) $10.50 per set.



No. 226-W—Type A. Price (in U S. A.) $7.00 each

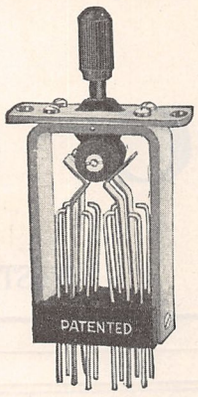
AUDIO FREQUENCY TRANSFORMER

The Famous FEDERAL No. 226-W Amplifying Transformer needs little introduction to radio experimenters, as its efficiency and amplifying qualities are well established.

ANTI-CAPACITY SWITCH

The name "ANTI-CAPACITY" SWITCH is derived from the fact that the capacity or condenser effect of this switch is practically immeasurable.

No. 1424-W. D. P. D. T. 12 spring. Price (in U. S. A.) $2.50.



Federal Telephone & Telegraph Co.
BUFFALO, NEW YORK

RADIO!

B. Batteries
Battery Chargers
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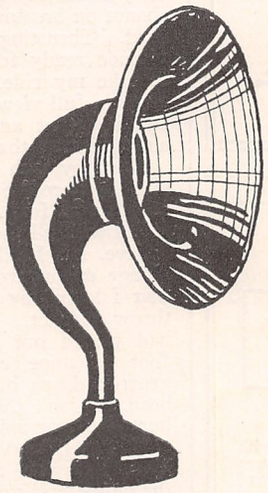
Rheostats
Receivers
Sliders
Sockets
Transformers
Tubes
Wire
Etc.



Nickel and Black Enameled Resonophone Horns—as Illustrated—$12.00

We Are Ready! Orders Filled Promptly!

IN Detroit, the center of the Radio industry, we are recognized as Headquarters for high-grade Radio outfits and equipment for receiving and transmitting. We have established our position of leadership and to maintain this position we continue to offer the very best materials and assure prompt service. No order too small! No order too large!

A 20% deposit must accompany every order!

"Nationally Known for Radio"

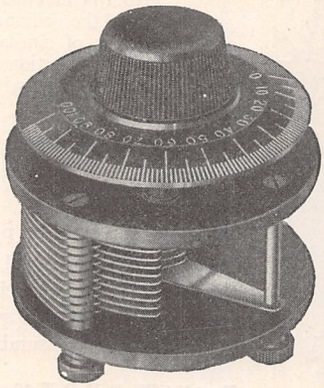
NATIONAL ELECTRIC SUPPLY & FIXTURE CO.
1338 BROADWAY - DETROIT, MICHIGAN

CONDENSERS

W M C

43 Plate with 3″ dial..... $5.00
23 Plate with 3″ dial..... 4.00
3 Plate with 3″ dial..... 3.00

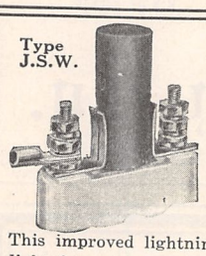
1½″ Rotary Switch Lever with 14 contacts, 2 Binding posts, 2 stops..... $1.00



W M C

WESTFIELD MACHINE CO., Westfield, Mass.

Type J.S.W.



Protect Your Home and Wireless Set Against Lightning This Summer With a JACOBUS Vacuum Protector

This improved lightning arrester is absolutely positive, efficient protection against the heaviest lightning storms. Approved by the National Underwriters to replace lightning and ground switches. Its simplicity, easy installation and forget-proof feature recommends it especially for the amateur.

Eliminates Ground Switches

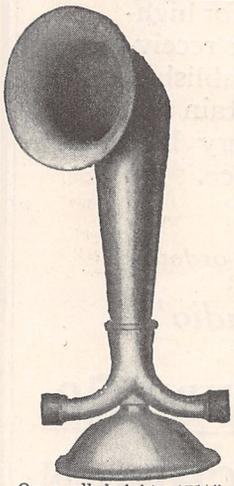
Receiving stations equipped with JACOBUS Protectors do not require lightning or ground switches. Protection every minute of the day and night. No worry about throwing switches.

Good For Innumerable Discharges

Discharges of lightning or static on the JACOBUS do not affect its life. After conducting a discharge to the ground, the tube is ready for another operation. Does not weaken or in any way affect the efficiency of the set.

$2.00 at Good Dealers

APEX ELECTRICAL SPECIALTY CO., Inc.
77 Orange Street, Newark, N. J.



Over all height, 17½″
Diameter of bell, 6″
Diameter of base, 6″

Immediate Deliveries of the

BRIDGEPORT LOUD SPEAKER $8.00

"THE HORN OF PURE TONE"

True reproduction of sound waves **without distortion** guaranteed with the Bridgeport Loud Speaker. The bell and horn is cast in one piece to eliminate "sheet metal bell," and thus does away with the "tinny" effect so undesirable in reproduction.

This horn is the only one entirely made of pure cast aluminum.

Body base of horn fits into socket, permitting free turning of horn in any direction without moving the base.

Yoke ends are provided with pure para rubber protectors. The finish is a handsome dull rubberized black.

Delivered anywhere in the U. S. on receipt of price plus 35 cents for postage.

Dealers write for attractive proposition. Immediate deliveries.

THE MONUMENTAL BRONZE COMPANY
Radio Department Bridgeport, Conn.

"I must have pulled the bridle sharply, because the horse suddenly jerked up his head in time to catch the bullet squarely between the eyes. I caught the flash of the rifle in the shadows of the underbrush and answered with my automatic as I slid to the ground. It was only a snap shot and, of course, missed.

"I hit the ground pretty hard and was slightly stunned for an instant. The horse swerved half-way around as if to run and then toppled over slowly. I tried to throw my legs out of his way, but he pinned the right one beneath his weight and I felt a sharp, searing pain shoot upward. Frantically I exerted all my strength to pull myself loose, but I couldn't. The pain was growing unbearable.

"My tugging seemed to arouse the horse and he made a move as if he were going to get on his feet. He threw his front legs out and lurched forward, but he was unequal to the task and sank back motionless, dead. But that one instant was sufficient for me. I was free of the weight and, under cover of the dead body, I made a hurried examination of my injuries. I was relieved to find that no bones were broken, but the ankle was dislocated and swelling rapidly.

"Cautiously I stretched out my foot and tried pressing a bit of weight on it. It hurt so I had to grit my teeth to keep from groaning aloud. I gripped my automatic and waited for the attack from in front. Straining my ears I listened for some sound to indicate the approach of my attackers, but I could hear nothing. It was as if the shot had frightened the woods into silence.

"My saddle-bags were still fastened to the cantle in front of me, although the flap had become loosened when the horse fell. With a sudden start I rememberd that the radio outfit was in it. In less than thirty seconds I had that machine out and was hugging it close to me. If anything in the world would help me out of that pickle I knew it was the wireless.

"The lower edge of the road was less than five feet away. The embankment dropped steeply for several feet down to a little ravine which was criss-crossed by several fallen trees. Still keeping my head below the level of the horse's body I peered over the edge and picked out a well-protected 'sink-hole' under those logs, which would command the entire hillside above me.

"I took off my coat and wrapped it carefully about my machine. I couldn't take a chance on breaking it in my plunge over the road. Thrusting my gun in my holster I made ready for the get-away. I wanted to take my rifle, but it was lying ten feet away in full view of the woods and to reach for it meant another shot. I didn't care about risking that.

"Inch by inch I wormed across the road, still sheltered by the dead horse. When within two feet of the edge I whirled and rolled with all the speed I could muster and, believe, me, I felt good when I felt myself plunge downward. It was done so quickly that I knew my enemy didn't have time to throw a shot. I crawled to the spot I had picked out and each time that game foot of mine came in contact with the ground, drops of sweat came to my forehead. I don't think I ever had anything to hurt like that ankle.

"I was behind the roots of an up-turned black gum tree and in a position to sweep the entire brink of that road over which my moonshiner would have to come, so I felt pretty safe as long as daylight lasted. After dark I knew I wouldn't have a chance. He would have help by that time. They always worked in pairs and more than likely his 'buddy' had already gone for assistance. It was after five o'clock and the shadows were beginning to lengthen out. Naturally I got busy with that wireless.

"Al. had shown us how to construct a 'loop aerial,' he called it, which didn't have to be raised more than six or eight feet from the ground. I got out my pocket knife and

A-P

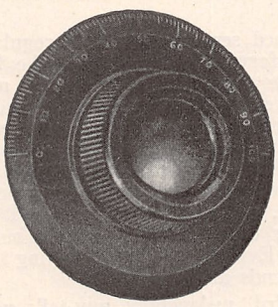
trade symbol for

Atlantic-Pacific Radio Supplies Co.

646 MISSION STREET, SAN FRANCISCO, CALIFORNIA
EASTERN OFFICE: 5 KIRK PLACE, NEWARK, N. J.

Radio Engineers Consulting Designing Construction

-MOULDED-RADIO-ACCESSORIES-



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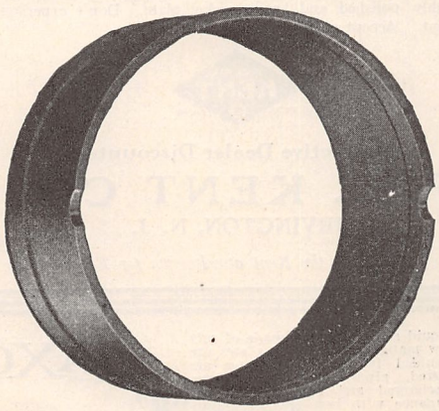
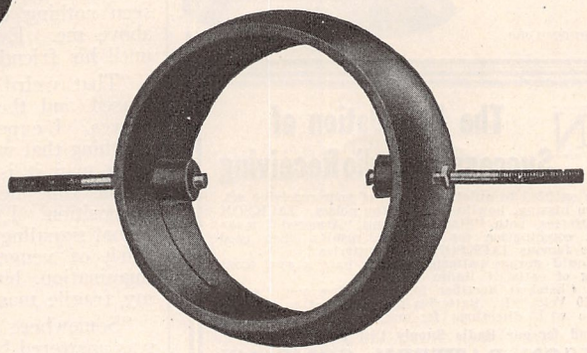
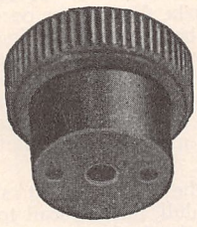
APPROVED MATERIAL

Specifications Solicited







Knobs Dials Rotors Couplers Panels Stators

INTERNATIONAL INSULATING CORP.

RADIO DEPT.
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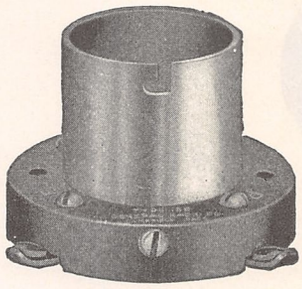
FACTORY
SPRINGFIELD, MASS.

THE SILENT SOCKET



Type 156 Socket

How many of the disturbing noises heard in your receivers are due to static, and how many to poor contact springs in your tube socket? Poor old static has to stand a lot of blame for other things.

Clean springs making firm contact with the tube prongs are essential for silent tube operation. Our Type 156 Socket is constructed with heavy springs, making a clean wiping contact on the side of the tube prongs. A positive contact is thus assured.

Remember also that these springs are heavy enough to carry, without arcing, the heavy filament current of the UV-202 transmitting tube.

POSITIVE CONTACT SPRINGS

Rugged—Attractive—Reliable

PRICE $1.50

Send for Free Radio Bulletin 911N

GENERAL RADIO COMPANY

Massachusetts and Windsor Streets

CAMBRIDGE 39 MASSACHUSETTS

Standardize on General Radio Equipment Throughout

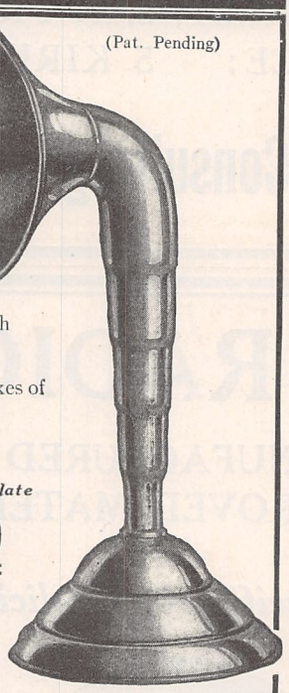
Carried by Leading Dealers

The KENTONE

REG PAT OFFICE

Radio Amplifying Horn

(Pat. Pending)



Your dealer's demonstration of the *Kentone* will prove to you conclusively that this horn is acoustically perfect. Made by a manufacturer of phonograph parts. Absolutely no distortion. The telescopic tone chamber construction is exclusive with the *Kentone*. Well made. All brass highly polished and heavy nickel plate. Don't experiment. Accept nothing but the *Kentone*.

15″ High
6″ Bell

Fits All Makes of Phones

TRADE MARK KENT REGIS PAT OFF

In Nickel Plate

$6.00

Attractive Dealer Discounts

F. C. KENT CO.

IRVINGTON, N. J.

Makers of the Kent attachments for Edison Disc Phonographs.

Liquid storage battery made of only new materials. Grids of plates are moulded individually. Plates are pasted, given a forming charge, discharged and recharged in accordance with best practice. Batteries delivered fully charged. Rubber and wood separators used. Variable Voltage, 18, 20, 22, 24 volts.

Price, each

$5.75 PREPAID OR FROM YOUR DEALER

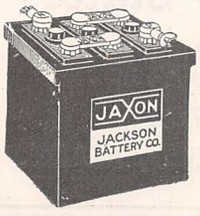
TWO-YEAR GUARANTEE

"B"

SENT EXPRESS COLLECT

"A"

"Permanenta" one-piece case of Armored "A" Radio Battery shown here is proof against leaks from plates to ground; fully tested for Radio use before leaving our factory; rubber and cedar separators; non-conductive and non-deteriorating.



"A" Armored

Fully guaranteed for three years.

6 volt 60 Amphr..$17.50
6 volt 100 Amphr.. 22.50

"Standard"

Wooden cases, cedar separators. Two-year guarantee.

6 volt 60 Amphr..$13.25
6 volt 80 Amphr.. 16.35
6 volt 100 Amphr.. 18.00

JAXON The Foundation of Successful Radio Receiving

You are entitled to quiet operation of your receiving set, free from hissing, howling and frying noises. JACKSON "A" batteries, both "Standard" and "Armored," make a great combination for excellent results when used with the famous JACKSON "B" batteries.

These liquid storage batteries already have a good-sized following of satisfied Radio fans.

Jaxon Chemical Rectifier for recharging one, two or three (80 Volt) "B" Batteries from alternating current. Complete with directions for use.....75c

Send for our Radio Supply List with Prices

JACKSON BATTERY COMPANY

1124 R. Jackson Blvd., Chicago, Ill.

Use This Coupon

Jackson Battery Company,
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Chicago, Ill.

Send me at once the following.....

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Send me Dealer Proposition.

Name.....

Address.....

City.....

Check ☐ here

cut the sticks and rigged the thing up in jig time. All the while I had to keep an eye on the road and the bushes above it. Once I thought I saw the leaves move slightly and I fired twice, more to keep him cautious than anything else. As long as he was sure that I was there he wasn't going to come out in an open scrap. His game was to wait.

"As I was fastening that 'loop aerial' to a pole so that I could raise it in the air, the mournful notes of that gun-barrel signal came to me clearly and echoed down through the little valley below me. I stopped and listened, thinking perhaps that it was a trick of the imagination. Again it came, the two short blasts followed by a long-drawn wail. It was the call of the clan; I had reason to remember it.

"That signal spurred me to action. I shoved my aerial into the air and propped the pole up with some rocks. As soon as I could connect it with my transmitter, I stepped on the key with the SOS for all it was worth. I didn't know enough about the thing to be absolutely certain it was working right, but it seemed to be acting like it always did. I cussed myself for not paying more attention to what Al. had told us about the insides of the thing.

"Right then began one of the strangest contests that has ever yet been staged. It was modern science pitted against mountain cunning, and darkness was the goal. The stakes—well I hated to think just what they were. I glanced at my watch and saw that I had a little more than two hours' grace. Twilight is short in the mountains and darkness comes with phenomenal rapidity. Again and again I sent out our distress call until I knew that if my apparatus was working Al. had received it. Alternating with that call I gave my position according to a rough map we had divided into sections for convenience.

"All the while that signal on the mountain-top kept up its insistent message. After a time he, too, dropped his first call of two short blasts and a long one, started a series of combinations something like the Morse code. That he was talking to his clansmen there could be no doubt—guiding them on across those crags and through the ravines and warning others to watch the roads for my men.

"I continued sending my calls regularly, although I fervently prayed that the boys were on the way. It was twelve miles back to our camp, if it was a foot, and on those mountain roads, it was almost impossible to cover it in less than two hours. If they had picked up my message when I first sent it they would have to race darkness to reach me. During all that time I had seen nothing of the outlaw in the bushes above me. Evidently he was laying low until his friends arrived.

"That weird, melancholy gun-talk never ceased, and the thing began to get on my nerves. I expect I was scared. If there's anything that will make the courage ooze out of a man it is to be crippled and in pain at the time he is up against a dangerous proposition. I felt so helpless, and that infernal signaling somehow seemed to echo the spirit of vengeance. I reckon it was my imagination, but it made me lose faith in my fragile machine.

"Somewhere in the distance that signal was answered by a dull, muffled wail totally unlike the clear call of the man on the mountain top. I knew that sound came through a heavy caliber rifle—at least a forty-five. And there was only one man in all those mountains who carried a gun of that size—'Black Dave' Farley, reputed to be the best shot in a country where all are experts. I stopped sending long enough to refill the chamber of my automatic and put an extra magazine within easy reach.

"Another of the gathering clan replied from the hills far over to the right and almost immediately he was answered from

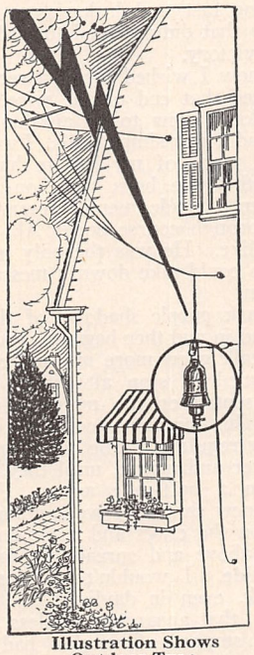

Illustration Shows Outdoor Type

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Absolutely safeguard your radio against lightning and static

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Cannot become grounded—cannot give trouble

No moisture, dirt or bugs can get into sealed chamber—no weak or lost signals

Beware of Air-Gap Types that spoil good signals

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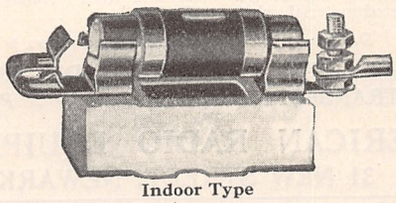

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A brief summary of the radio goods listed in this catalog:

The entire radio catalog of the Radio Corporation, with a wealth of scientific and technical data on C.W. transmitting sets, and all the diagrams for the assembling of these sets; the complete Remler catalog, which embraces 25 pages, the Westinghouse, Firth, Murdock, Federal, DeForest, Clapp-Eastham, Brandes, Connecticut Company, Thordarson, Turney, Magnavox Company catalogs, the best products of Adams-Morgan, Signal and countless other manufacturers, including our own complete line of radio apparatus, and many individual items and parts used in radio work today.

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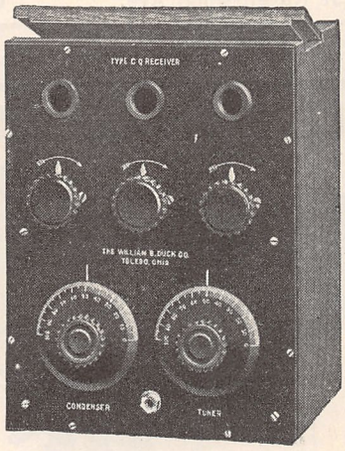

Our new Type "CQ" receiver with detector and two step amplifier is truly a DeLuxe Receiver. Cabinet of genuine mahogany, handsomely finished in its natural color. Formica panel. All connections from rear. No set offered to the public today combines so many dominating features. On the basis of intrinsic worth we are warranted in asking twice the price. Extreme simplicity in operation, sharp and selective tuning, clear and sweet reception of music and speech, the entire elimination of body capacity effects, none of the minutely painstaking adjustments characteristic of so many receiving sets on the market, permanence of adjustment—these are among the dominating and much to be desired features that characterize our "CQ" Receiver.

Type "CQ" Receiver $85.00

In tests here Schenectady, N. Y., Atlanta, Ga., and Newark, N. J., from 400 to 700 miles distant came in with sufficient strength to be audible in any part of a room 12x15 feet. Chicago, Pittsburgh and Indianapolis were plainly audible in receivers.

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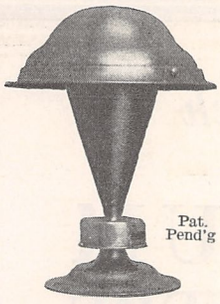
Note—The above receiver is complete excepting the usual accessories. These comprise detector and amplifier bulbs, $18.00; two "B" batteries, $3.50; storage battery, $15.00; antenna material approximately $12.00 a head set as selected. Western Electric from stock at $15.00.

Send only 25c for copy of this wonderful catalog. You will need no other when you have Duck's, and you cannot find in all others combined what you will find in Duck's Wonder Catalog.

The WILLIAM B. DUCK CO., 231-233 Superior St., Toledo, Ohio



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The S & C High Voltage Fuse in Combination with Two Enclosed Close Spark Gaps, Direct to Ground

Eliminates { Danger To The Operator / Danger To The Receiving Set / Danger To The Building

No more worry about that Ground Switch—You need None.

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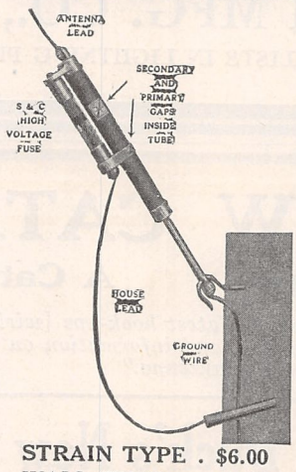

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STRAIN TYPE . $6.00
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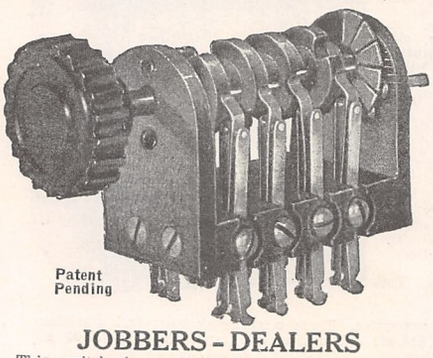

Patent Pending

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The MULTIPLEX ROTARY SWITCH takes the place of filament control jacks in the vacuum, tube control panel, giving much greater convenience at lower cost. With this switch you may change from detector to any desired stage of amplification by merely turning one knob. Filaments of unused stages being automatically extinguished.

UNIVERSAL IN USE

This switch is adjustable, by loosening one nut the cams may be adjusted to meet practically any switching requirements.

SPECIFICATIONS

INSULATION—BAKELITE
SPRINGS —NICKEL SILVER
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PRICE - - - - $5.00

If your dealer cannot supply you write us, giving his name.

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This switch is revolutionizing amplifier construction, owing to convenience of operation. It will be to your advantage to write for our attractive proposition.

MANUFACTURERS

Why not use this switch in your sets? Write for details.

STORM-LEE RADIO APPARATUS CO.

742 HIGHLAND AVENUE NEWARK, N. J.

over in the opposite direction. Still others picked it up and again the woods seemed filled with the deadly music, much as it was on the day I lost my prisoner. The clan was coming fast, and dusk was settling with a rapidity that did not tend toward assuring me of a victory.

"God, how I wished I had a receiver and had learned that end of the wireless game. I didn't know how to do anything with it except send a few simple calls. I would have given ten years of my life to have had a message that the boys were on the road. Right then I made mental reservations to take a thorough course under Al., if I ever got out alive. He was the only one in the outfit who could take down a message when it came in.

"The dark purple shadows of the mountains closed in and then began to grow dusky. The gun-talk grew more intermittent and at times seemed to stop altogether save for the lone sentry on the mountain-top. He continued his ominous conversation with maddening regularity. The occasional replies drew nearer and nearer, until they were not more than a half-mile away. From the sound I knew that they were going to join the man on the crags and come down upon me from above and spread out fan-shaped on each side. I wouldn't last long under that attack, even in daylight.

"Finally, that apparently endless signaling above me stopped. The clan had reached him and he was leading them down the winding path. The sudden silence seemed oppressive. I disconnected my machine from the aerial and pushed it under the log. There was nothing to do but await the result of the contest.

"Somewhere up the mountainside an owl hooted dismally to its mate, and a wood-thrush called sleepily. But there came no sound from the closing clan, which I knew was within a few hundred yards and drawing nearer each instant. I wondered if my men would be able to find me if they arrived at the foot of the mountain. Then I assured myself with the knowledge that I had two of the best trackers in the world in my gang.

"S-s-s-s-sh!" The warning came from so close behind me that I almost sprang erect. I whirled with my gun ready for instant action and then heaved a sigh of relief. *I had won.*

"Red Rodifer, my lieutenant, was crawling up the gully toward me. He had got within fifteen feet of me without making the slightest noise. I don't think any other man in the game could have done that. He was like an Indian. I caught a movement behind a tree a few yards back of him and I knew that the boys were with him.

"Red slid in beside me, and without a word, produced a bottle of carbolic acid and bandages and went to work.

"'How'd you manage to find me?' I asked.

"'Their signals helped. We called a council of war half a mile back. Heard them signals and figured you were here. I sent Cartright with six of the boys to come in from above after the shootin' starts. We'll corner 'em sure as hell. Eight of the boys are here with me.'

"'So you got my message?'

"'Sure! All the boys had come in and they were wondering what had happened to you. Say, where's your rifle?'

"I started to tell him when the flash of a gun split the gathering darkness near the roadside above us. Red replied with a couple of shots and was backed up by the boys still further down the hillside. A scattering volley from the cover of the trees on each side as well as in front caused us to crouch deep within the shelter of a log.

"That cordon of fire drew closer. They outnumbered us and they knew it. There must have been ten or twelve of them and there were only eight of us spread across the hollow. We moved about as much as we dared without exposing ourselves, so that they could not see by the flash of our rifles

HOME-O-FONE

Radio Telephone Receiving Set

$24

COMPLETE
Including Antenna, etc.
No batteries or tubes needed.

EVERY SET GUARANTEED

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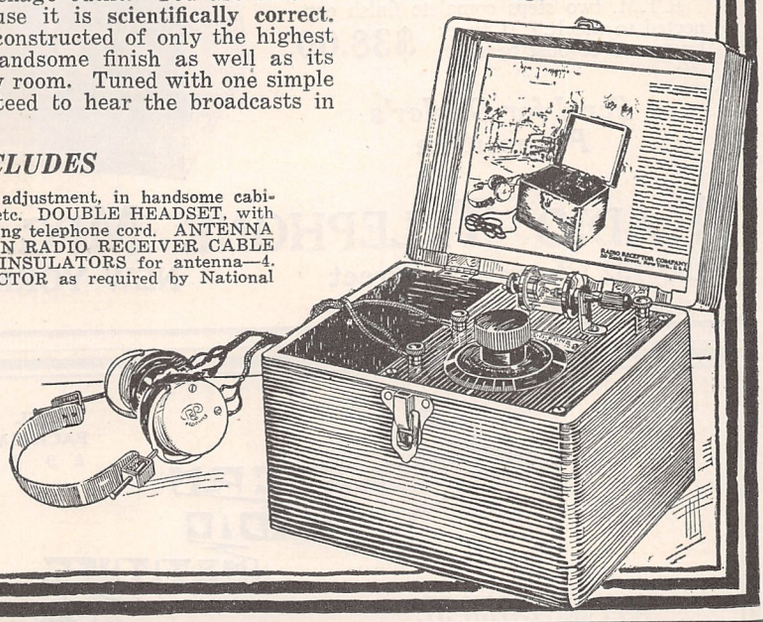
COMPLETE OUTFIT INCLUDES

HOME-O-FONE No. 2 RECEIVER with precision tuner adjustment, in handsome cabinet-finish case with cover and compartment for headset, etc. DOUBLE HEADSET, with 2 special "RR" concert phones, 2200 ohms, headband and long telephone cord. ANTENNA WIRE—150 feet. GROUND CLAMP. HIGH INSULATION RADIO RECEIVER CABLE for room connection—25 feet. SPECIAL PORCELAIN INSULATORS for antenna—4. "ANCHOR" AUTOMATIC RADIO LIGHTNING PROTECTOR as required by National Underwriters' Rules. INSTRUCTION FOLDER.



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Send for folder containing Antenna drawing.

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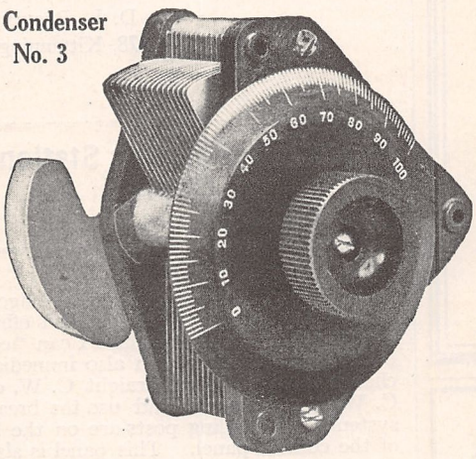

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Variable Condensers

(Die-Cast Type)

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No. 3.—.0011 m. f.	unmounted	4.75
No. 3.—.0011 m. f.	unmounted, without dial	4.35
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Top, bottom and knob are genuine bakelite, shaft of steel running in bronze bearings, adjustable tension on movable plates, large bakelite dial reading in hundredths, high capacity, amply separated and accurately spaced plates.

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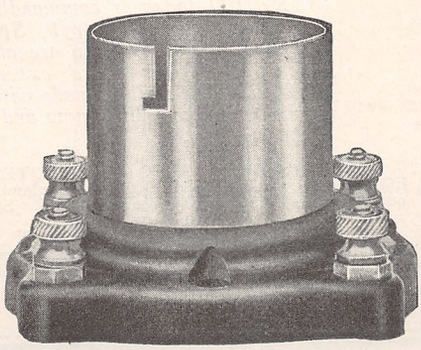

"Chelsea Bakelite Socket No. 60"
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Positive contact springs.
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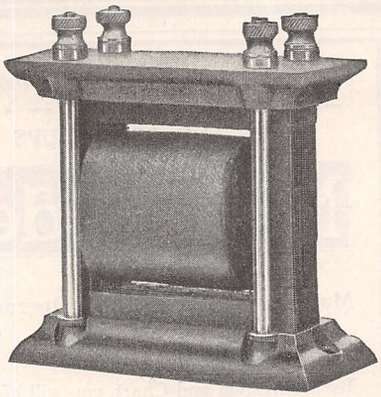

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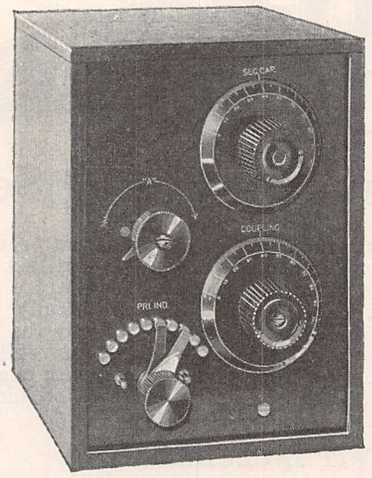
Has a Tuning range of 150-650 meters. Tuning is very simple, brings in the music sharp and clear. Cabinet has mahogany finish, panel is made of hard rubber and has also the appearance of mahogany finish. All wiring is in the back of the panel, thus giving it a very neat front appearance. The B battery is contained within the set and outlets for A battery leads in the back. Price..... **$38.00**



R.T.M. two steps complete finish connected to the R.T.M. tuner by means of bust bars.... **$38.00**

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RADIO today is commanding the interest of more people than any other industry! Splendid opportunities are NOW available for those who are alive enough to see the possibilities. My fifteen years' experience in Radio tells you that FORTUNES will be made within the next five years for those who train themselves now and take advantage of the present opportunities.

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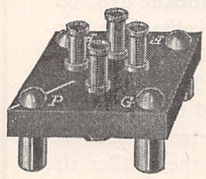

A V. T. socket with many distinct advantages. *Greater contact surface, giving better connections that will not work loose. Pins mounted on genuine polished bakelite base, fused to prevent burning out tube.*

Fits any standard four-prong tube **$1.00 ea.**

Variometers, vario-couplers, miniature plugs, phone tip jacks, phone connecting block, grid condensers, grid leaks, variable condensers, etc.

Write for descriptive literature and price lists.

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MEMPHIS, TENN.
Formerly V. H. LAUGHTER

(My) (Name) (Is)

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By my System and Chart, you will know the Code in 30 minutes. Get the real thrill of "Radio News"

Complete System, $1.00
Ask Dealers or Direct

H. C. FAIRCHILD

588 Broad Street, NEWARK, N. J.

where to concentrate their fire. Then gradually their guns grew silent. They were preparing for a rush and Red began to swear softly to himself. At rough and tumble fighting the mountaineer is unbeatable, and Red knew it.

"Where is Cartright? He ought to be here now.' Red was worried and so was I.

"Then it happened. That bunch of 'nuts' under Cartright decided they didn't like fighting behind trees. They wanted action, and they got it. They reached a point about fifty yards above the road and then rushed pell-mell among those moonshiners shooting and yelling like a bunch of Indians. The attack was so unexpected and so darn unusual that the Farleys were swept clean off their feet. In fact they didn't have time to defend themselves.

"They sprang for the road and over it, down in upon us. With Red in the lead the rest of the boys closed in and the battle was red hot for about ten minutes. One of our boys was killed and two of the Farleys. Several of the others had a bullet 'hole' or two, but we made a complete job of it including the capture of 'Black Dave.' And, believe me, when the boys carried me out that night, I had my little wireless set tucked away with me on that pole-litter."

D. L. Brown's Station at Kittanning, Pa.

(*Continued from page* 44)

interested in the Radiophone more than the telegraph. The set gives fair results. I can hear KDKA at East Pittsburgh, Pa., 20′ from the phones without amplifiers. With the two stages I can hear it 100′ away. I can hear NSF all over the room. NAA comes in so loud that it can be heard 200′ away.

I enjoy reading RADIO NEWS and wish it and its readers the best of luck in the game.

D. L. BROWN,
Box 478, Kittanning, Pa.

Frank D. Fallain's Station, 8AND

(*Continued from page* 43)

and receiver. It contains high voltage regulation as well as a simple and efficient change-over switch with which I can "comeback" immediately. Can also immediately change from voice or straight C. W. or I. C. W. or compensate, and use the break in system. All binding posts are on the back of the control panel. This panel is also of my own make.

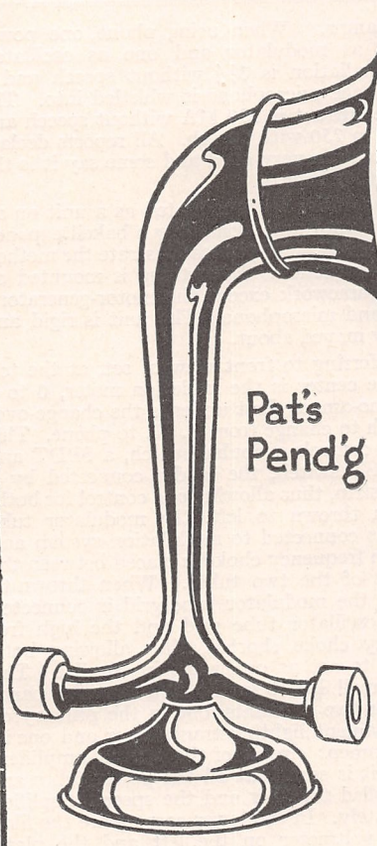
Directly below the control panel is the filter system and below this on the desk are the keys. There is an extra key for chopper, experimental work, etc.

At all times I use A. C. on the filaments furnished by a step down transformer with center tap. D. C. supply is a Robbing & Meyers M. G. Set.

The station is located in my offices in the down-town section, and it is not possible to work every night on account of the induction QRM.

As my call is a re-issued one and does not appear in the new call books under my name I will be thankful for reports from all those having heard 8AND working since August, 1921. All letters or cards will be answered and the reports will be highly appreciated. Address all correspondence to Frank D. Fallain, 321 1st Avenue, Flint, Michigan, or to my offices, 104-5-6 Walsh Bldg., Flint, Michigan.

Compare it with ANY
It SPEAKS for ITSELF



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Listen to the Concerts, News, and Dance with a **KING "AM-PLI-TONE."** Just slip your head phones on the **"AM-PLI-TONE"** and you and your friends will be **SURPRISED.** Polished Cast Aluminum Body with Nickel Plated Base and Horn. No **Sheet Metal** is used, the **"Tinny" Sound is Left Out.** The **VOLUME** is **DOUBLED** because **TWO** head phones are blended into one **POWERFUL** tone.
A BIG HIT—A BIG SELLER and IMMEDIATE DELIVERIES.
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1916 First Trans-continental Amateur Transmission (New York to California; not pre-arranged) effected by PARAGON designed transmitter.

1917-1918 PARAGON acknowledged supreme on Western Front.

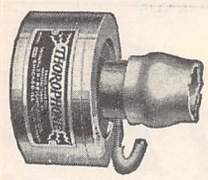
1921 First Trans-Atlantic Amateur reception effected with PARAGON receiving equipment, at which time 27 different amateurs scattered thruout the Eastern section of the United States registered signals at Ardrossen, Scotland—3500 miles.

THERE'S A REASON!

The ADAMS-MORGAN CO.

Manufacturers

UPPER MONTCLAIR, N. J., U. S. A.



Model 601 Thorophone with Victrola Attachment. Price.....$20.40

THOROPHONE

(THUNDERPHONE)

TRADE MARK REG.U.S.PAT. OFFICE

GREAT RADIO VOICE

The Thorophone Real Loud Speaker. Beautiful Tone and Great Volume. Ornamental Concert Horn. Scientifically constructed with Controlled Mica Diaphragm.

Model 501 Thorophone Complete with Concert Horn. Price.....$35.00

Manufactured by

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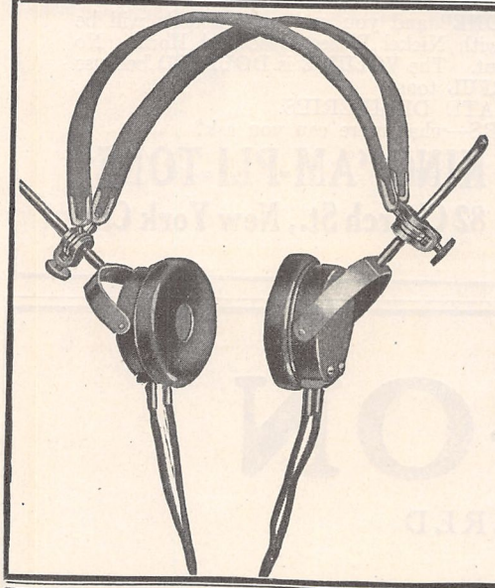
Oldest manufacturers of loud-speaking telephones in America. Only successful makers of large paging systems. Our loud speakers are used for paging in the great hospitals, hotels, clubs, railway stations, baseball parks and for giving general orders in the U. S. Navy.

Mail Orders attended to promptly. Send money order, check or draft for purchase price. Thorophone will be sent by express or insured parcel post; charges collect. Production of Radio type just coming through. These are not yet in the hands of dealers. Mail orders will be filled first and in the order of receipt. If shipment can't be made within one week, best delivery date will be advised and your money returned if desired. If you wish to return the Thorophone for any reason whatsoever, do so within ten days and your money will be immediately refunded.

Dealers, write for proposition—one outfit only sent to dealers on trial, money-back basis.



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A highly satisfactory service for radio dealers. Good stocks of practically all the most important manufacturers. Immediate shipment made on all items. Write for catalog and list of liberal discounts. Test our service.

WHOLESALE RADIO EQUIPMENT CO.

23 William Street NEWARK, N. J.

Louis Falconi's Station 5ZA

(*Continued from page 42*)

milliamps. When using phone, one power tube as modulator and one as oscillator, the radiation is 3½ without speech and 4 when the microphone is whistled into. The plate current is 150 MA without speech and goes to 250 with speech. All reports declare modulation very good and some say it is the best they hear.

The entire set is mounted as a unit on an aluminum frame fronted by a bakelite panel, 18″ by 24″. The photos illustrate the method of construction. Everything is mounted on the framework except the motor-generators, key and microphone. The unit is rigid and easily moved about.

Referring to front view of set, at the top of the center is the radiation meter, 0 to 5 thermo-amps. Just under is the change-over switch to change from C. W. to phone. This knob controls a double switch, a SPDT and a SPST switch, the blades connected by a fibre strip, thus allowing one control for both. When thrown to left, the modulator tube grid is connected to modulation system and a high frequency choke is placed between the plates of the two tubes. When thrown to right, the modulator tube grid is connected with oscillator tube grid and the high frequency choke shorted, thus allowing both tubes to act as oscillators in parallel. The two small knobs in the center of the panel are for two rheostats, one in the primary of the filament lighting transformer and one in the filament circuit of the speech amplifier. Thus it is seen that all the power tubes are controlled together and the speech amplifier separately. In the lower corners are the filament voltmeter on the left and the plate milliamp. on the right. Between the two meters is an adjustable unit of the grid leak resistance for exact adjustments. When not in use it is shorted as shown in the photo. Immediately under variable leak is the microphone jack and binding posts for key and storage battery. The microphone jack is so arranged that upon insertion of the plug, the microphone is connected and the filament of the speech amplifier tube lighted. Thus the speech amplifier burns only when the plug is in the jack. The large post in upper right corner is for aerial connection. The small three-point switch to left throws the voltmeter from power filaments to amplifier tube filament, the center contact being dead so that the higher voltage of the power tubes will not be thrown on the speech amplifier filament while changing the meter from one to the other.

As will be noticed in the photo, windows are cut into the panel and copper screening placed over them to give a good appearance.

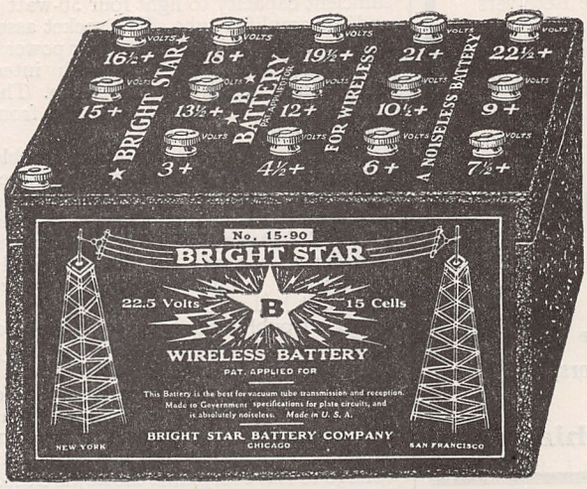
On the left side of photo can be seen part of the inductance with grid control handle sticking out. Below the inductance are the resistances for the speech amplifier and below them is a small panel on which is mounted the speech amplifier tube, coupling condenser and modulation transformer. The binding posts connect to the biasing batteries for modulator and speech amplifier tube grids.

Referring to the back view of the set, the inductance is plainly seen at the top. The large coil is on a tube 5½″ in diameter. This is threaded five to the inch and 40 turns of No. 8 hard drawn bare copper wire wound on the tube. For connection to same, lengths of the same wire ½″ long are soldered to every other turn. Two such rows of contacts are soldered on, one for the antenna connection and one for the plate connection. Plugs are made out of brass rod bored to fit the short lengths of wire contacts and handles of bakelite or hard rubber fitted so that the adjustments can be made with the juice on. The grid coil is on a 4″ tube and has 50 turns of No. 14 S. C. C. copper wire tapped every

GET THE BEST RESULTS FROM *YOUR* WIRELESS

USE BRIGHT STAR "B" BATTERIES

Don't Be Satisfied With Inferior Results Caused by Not Using the Best



NO. 1590 WITH 15 TERMINALS

THE BRIGHT STAR "B" BATTERY

NOISELESS—Allowing Clear-toned Reception.

LONG SERVICE with Sustained Voltage.

STRONG RECUPERATION Between Periods of use.

BINDING POST TAPS—Making Connection Positive and Easy.

BRIGHT STAR BATTERY CO., DEPT. R

NEW YORK :-: CHICAGO :-: SAN FRANCISCO

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Send in Your Orders Now and Benefit by Our Increased Facilities to Take Care of All Needs in Radio

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No. UV-200	Detector	$ 5.00
No. UV-201	Amplifier	6.50
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A. P. Detector	5.00
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Send us your orders for Tubes.
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No. UP-552	Radio Corp.	1.50
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No. UC-1014		2.50
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BRAIDED AEROPLANE ANTENNA WIRE

Per 100 ft.	.50
No. 14 Bare copper wire, per 100 ft.	50

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No. CR-5	Grebe 175-3000 meters	80.00
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No. UV-712	Radio Corp.	7.00
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No. UP-1368	—325 watt	25.00
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Please include sufficient postage with all C. O. D. orders

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ASK FOR A "PRAMCO" UNIT
TRADE MARK

Includes All Necessary Panel Mountings for a Complete Crystal Receiver

CONTENTS

18 Switch Points with Nut
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2 Large Binding Posts for Antenna and Ground
2 Small Posts for Telephone Receivers
2 Switch Levers, 1½" Radius
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Our New Literature Now Ready for Dealers
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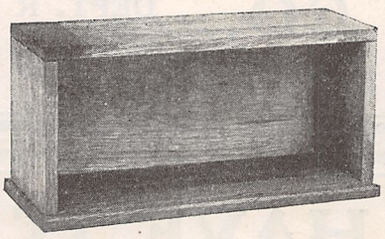

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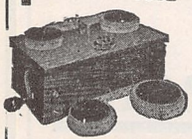
Wireless Operators Wanted

LEARN WIRELESS AT HOME IN SPARE TIME

The demand for experts exceeds supply. Pays big salaries, $125 to $250 a month to $10,000 a year. Our home course will make you an expert operator in shortest possible time. Instruction by radio experts. We give you Best Theory, Text-Books, and Two Instruments Free, the wonderful Omnigraph and

FREE VACUUM TUBE **Wireless Phone** AND CODE SET



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Special Low Cost, Quick, Simple

AMATEUR WIRELESS COURSE

Qualifies For Amateur License

FREE Learn-O-Graph Code Sender given with Amateur Course.

Write for booklet "How to become a Wireless Operator."

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MORSCAN

Wireless Supplies and Equipment at Wholesale

MORSCAN RADIO CO.
196 Market Street, Newark, N. J.

10 turns and the taps brought to a switch fitted to the end of the tube. The switch shaft is made very long so as to project from the side of the set, thus allowing the same handle to adjust the coupling and also the inductance of the grid coil, making it unnecessary to stick one's hand on live wires to adjust the grid coil inductance. The grid coil slides on two brass rods attached to big coil; photo shows how this is done. The rheostat under inductance is in the primary of the filament transformer. The filament transformer is under the rheostat and is home-made with sufficient capacity to light four 50-watt tubes and the amplifier tube. The socket assembly is home-made, has places for four power tubes on a single bakelite base with inter-grid chokes and protective gaps built in. The rest of the apparatus can be obtained from the hook-up given.

When first placed in operation, trouble was experienced from the flickering of the filament voltage due to the voltage drop on the power line when the generators took the juice. Unfortunately the power line was not of sufficient capacity for the work and thus the flicker. That made the note very bad, that is, it had a squealing effect. For those who are troubled the same way, the hook-up shows how this may be cured. A relay was connected in the negative lead of the 1000 volt D. C. line and arranged so that every time the relay closes, a small resistance in the primary of the filament transformer is shorted out, thus allowing the filament voltage to rise every time the key is closed and juice flows from the high voltage generator. By making the resistance variable, any drop can be taken care of in that manner, a heavy drop requiring a greater resistance than a slight drop. The filament voltmeter can be made to be absolutely steady.

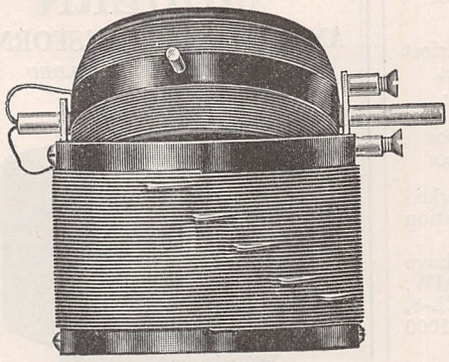
Another "stunt" used which I have not seen described before, is the way the chopper is connected. It is placed in the ground lead and a small inductance shunted around it. It then alters the wave by a few meters so many times per revolution and any note can be obtained. This method of chopper modulation has proven quite effective and has good carrying qualities.

The power for the set is furnished by two generator sets, each giving 500 volts and 400 milliamps. Allowing 100 ma. per tube, it is seen that the power unit is just large enough to feed four 50-watt tubes for C. W. For phone, the plate current is usually lower.

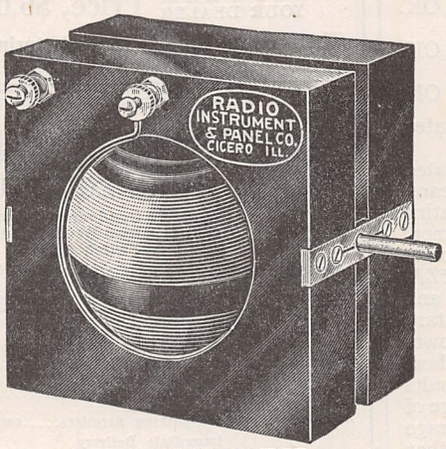
Although using only two 50-watt tubes to date, the results have been remarkable both on phone and C. W. The speech amplifier has just been installed and the results reported on the phone were made during a few short periods of operations.

On March 2, 3, 4, 5 and 8 the following stations were worked with use of the phone only and no trouble experienced, the stations reporting signals VY QSA and modulation OK.

		Distance, Miles	Reception
	MARCH 2		
9BHE	Glen Ellyn, Ill.....	1,000	Perfect
6AWP	Santa Ana, Calif...	700	Perfect
9AIG	Sioux Falls, S. D...	800	Perfect
9TI	Milbank, S. D.....	900	Partly
5XB	State College, Texas	450	Perfect
5MT	Laredo, Texas.....	500	Perfect
9PI	Eureka, S. D.....	900	Partly
9AVZ	Pierre, S. D.....	850	OK
5XD	State College, N. M.	250	Perfect
	MARCH 3		
5XB	State College, Texas	450	Perfect
9AEG	Shenandoah, Iowa.	700	Perfect
9AAS	Owensboro, Ky....	975	Perfect
9SL	Milton, Iowa.....	750	Perfect
9DZJ	Great Bend, Kans.	400	Perfect
9ZAF	Denver, Colo.....	450	Perfect
5ZE	Houston, Texas....	550	Perfect
5XD	State College, N. M.	250	Perfect
	MARCH 4		
9SL	Milton, Iowa.....		
9AAY	Chicago, Ill.....	1,050	OK
9AKR	Lanark, Ill.....	1,000	OK
6ZZ	Douglas, Ariz.....	300	OK
6ZG	Los Angeles, Calif..	750	OK
9ZJ	Indianapolis, Ind...	1,050	OK



COUPLER



VARIOMETER

IMMEDIATE DELIVERY

GET THESE POINTS:

All wooden parts carefully impregnated with a black high dielectric strength, non-inflammable, water-proof compound. All positive "Pig-tail" contacts. Bearings will not bind. All metal parts white nickeled. Rotor balls solid mahogany. Windings of green double cotton covered wire, guaranteed not to peel or come loose.

Make your own highly efficient regenerative set with 2 of our variometers, a loose coupler and necessary parts at a small expense.

IMPROVED VARIOMETER

Binding posts have large knurled thumb nuts. Wood forms accurate. Minimum clearance between rotor and stator. Mounts easily, and is designed for low Dielectric losses and maximum range of induction. Black rubberized finish will not chip or peel off. Effective tuning range of 150 to 650 meters.

IMPROVED COUPLER

Primary windings on black formica tube. Has 6 taps for varied induction. Rotor held by spring clip, making it possible to hold range when once found. Easily installed. Will operate perfectly and give highest efficiency. Save money by using this cheaper and better equipment.

LOOK AT THESE BARGAINS

Hard Rubber Variocouplers. Primary wound on hard rubber tubing. Secondary wound on hard rubber ball. Green cotton covered wire. **$5.00 Each**

Variable Condenser assembled without dial:

21 Plate	$3.50
43 Plate	4.50
1-Piece Moulded Vacuum Tube Socket	.75
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Fibre Panels Cut to Size, ¼" Thick, .01½ cents per square inch.

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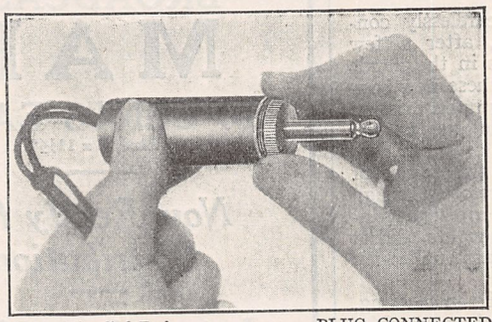
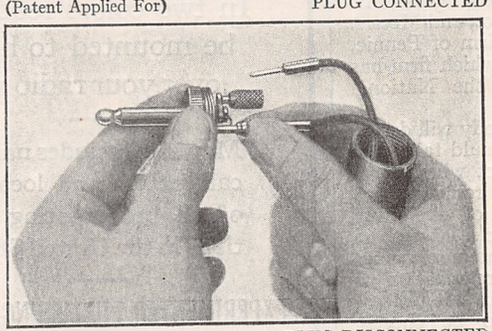


(Patent Applied For) PLUG CONNECTED



(Patent Applied For) PLUG DISCONNECTED

The best for professionals and amateurs.
Positive contact in easiest, quickest way.
Fits any size of telephone tip.
A simple turn of the adjustable bushing with finger and thumb connects wire to plug.
No tools needed to attach tips.
Unnecessary to cut telephone tips.
Fits any standard jack.
Price, $1.50 each.
If your dealer cannot supply you, order direct.

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Providence, R. I.

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Order from Your Nearest Radio Dealer

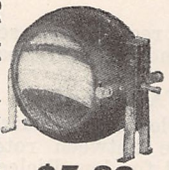
"The Plug That Holds"

5 of our many big bargains

VARIOMETER

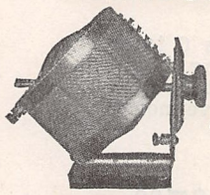
No wood! No composition! Rotor and Stator of hard rubber.

Best insulator known! Nickel-plated hardware. Beautiful design. Shape of Stator conforming with that of Rotor, saving space on panel board.....



$5.00

VARIOCOUPLER



Fiber tubing, hard rubber Rotor.

Green covered wire. Nickel-plated hardware. Large size; 180° adjustment.

$4.50

3-INCH DIAL

Hard rubber. One piece. Highly finished.

75c

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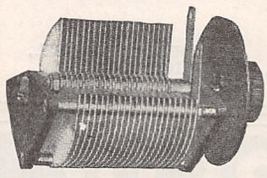

21 Plates
Capacity, .0005 M.F.D.
$3.50

43 Plates
Capacity, .001 M.F.D.
$4.50

Nickel-plated hardware. Aluminum plates. Specially constructed.

TUBE SOCKET

One piece. Moulded.
Nickel-plated hardware.
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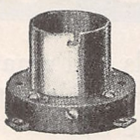

Do not buy wireless apparatus of any kind before getting our prices

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RADIO MEN NEEDED!

THERE is at present a great demand on this school for men trained in Radio. Manufacturers of Radio equipment are constantly asking for men for various positions at nigh salaries. Thus far the demand has exceeded the supply.

We can train you in a short time to qualify for one of these positions.

Complete course covering Arc, Spark and Vacuum Tubes systems.

Y. M. C. A. RADIO SCHOOL
158 East 86th St., New York, N. Y.

MARCH 5

9WU	Ellendale, N. D.....	875	OK
9AAS	Owensboro, Ky.....	975	Fair

MARCH 8

5ZAE	Waco, Texas.....	400	Perfect
LK	U. S. S. Bache.....	104 miles S.E. Gulfport, Miss.	Poor
5HK	Oklahoma City.....	500	Poor

The above stations were actually worked with, and in most cases 5ZA was the station called.

Using straight C. W., the following have been worked with: 8ZZ, 2ZL, XF-1, NMW, 8VY, 7XF, 4FT, 8ZG, 8XV, 8XH, and CL-8, others closer. Those named are over 1000 miles.

The phone has been reported as follows. Only the longest distances will be given.

Stonen, Saskatchewan, Canada
1,400 miles. Reception, OK.
8YR, Miami Univ., Oxford, Ohio
1,150 miles. Reception, OK.
8BYN, Detroit, Mich.
1,275 miles. Reception, OK.

The phone has been heard in 25 states, Canada and Mexico.

The C. W. has been heard in all states, Canada, Mexico, Hawaii and on both Oceans.

Many letters have been received stating that phone signals and modulation were more QSA than radiophone in Chicago, 25 miles away. Others closer to KDKA than to 5ZA, state that signals on phone are clearer and stronger than KDKA, quite complimentary it must be admitted, considering the power used. But then it is supposed that these were freak transmissions. The above results fully demonstrate that a phone for a range of 1,000 miles is not out of reach of the average amateur. The wonder is that distances that were considered records for high-power spark sets and C. W. sets last year are easy for phone sets this year. Radio is truly advancing.

Radio Digest

(*Continued from page* 59)

are placing on the market carelessly constructed merchandise, which, after a few months' use, will be worthless in the hands of the consumers. Many of these new concerns are innocently infringing upon existing patents. This infringement is due to the fact that the financiers back of these concerns have taken for granted the advice of some so-called expert, and therefore, through ignorance or unscrupulousness, are clearly infringing Government granted rights, either in the form of patents or patents-applied-for of the older manufacturers.

Among those who addressed the meeting, besides the officers mentioned, were Mr. Andrea of F. A. D. Andrea & Co., and Messrs. Russ and Taylor of the law firm of Pennie, Davis, Marvin & Edmonds—which firm has been appointed counsel for the National Radio Chamber of Commerce.

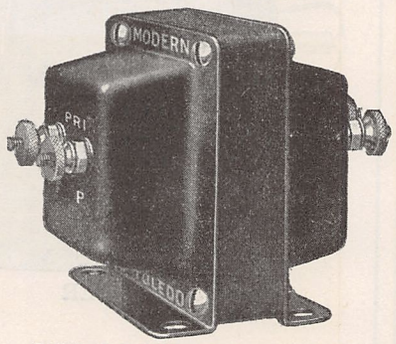
It is also planned that this body will decide whether or not its members should take part in public radio shows, many of which have been started throughout the country, and run merely for the purpose of exploiting manufacturers' and the public's interest in Radio. The Chamber of Commerce does not plan to undertake the organization of radio shows, on its own part, at this time.

A Credit Bureau will also be shortly organized for the interchange of credit information.

EDITOR BROADCASTS FINANCIAL NEWS

Commerce follows closely the footsteps of the scientists over the paths blazed by new and startling discoveries.

"MODERN"
AMPLIFYING TRANSFORMER
COMPLETELY SHIELDED



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The Modern Electric Manufacturing Co.
TOLEDO, OHIO

CONNECTICUT
RADIO EQUIPMENT

Variable Condensers, Transmitters, Head Bands, Panel Switches, Etc.

Connecticut Tel. & Elec. Co., Meriden, Conn.

"GALENA"

Grade A.A. tested extra large piece.....	$.20
Beautifully designed binding post N. P.....	.08
Contact Points, N. P., per dozen.....	.30
Ideal Broadcaster Receiver.....	12.00
Approved "Argus" Lightning Arresters.....each	1.50

Immediate Delivery

IDEAL RADIO MFG. CO.
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OFFICIAL RADIOPHONE BROADCAST MAP

10 CENTS EACH
Size 16 x 11½"

Now Ready for Distribution

In two colors ready to be mounted to hang over your radio set

Map also includes names, call letters and location of all broadcasting stations in the United States

EXPERIMENTER PUBLISHING CO., INC.
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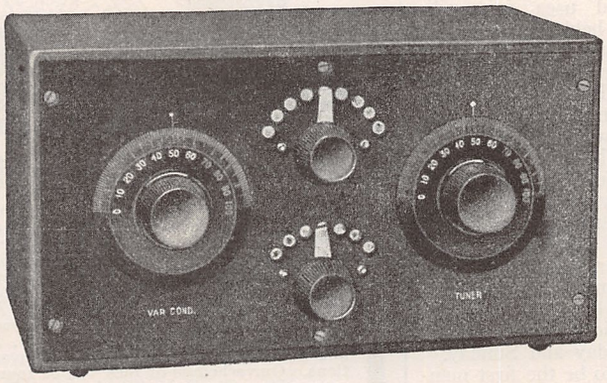
Enclosed find ten cents for which send me copy of Official Radiophone Broadcast Map.

Name.....
Street.....
City.....State.....

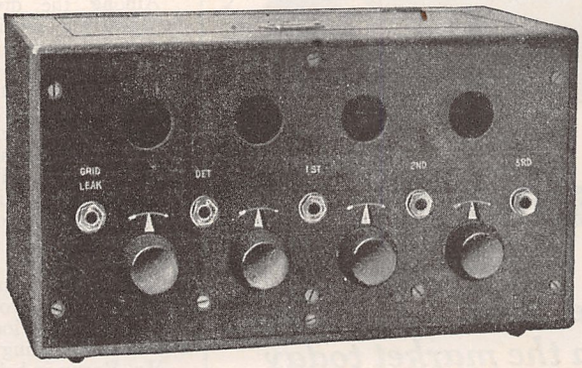
THE WINKLER RECEIVER
(Wave Length Range 150-2500 Meters)



TYPE 104 (Illustrated above) PRICE $50.00

This receiver when used with a Winkler Type 4A or 4B makes an ideal set for receiving all broadcasting news and concerts up to 2500 meters. Will not be affected by any change in wave-length regulations.

THE WINKLER DETECTOR
AND 3-STAGE AMPLIFIER



TYPE 4B (Illustrated above) PRICE $85.00

Eliminates the use of a power amplifier for a loud speaker.
Also Type 4A Detector and 2 stage amplifier of same high grade construction as Type 4B. Price, **$60.00.**

The above sets are of the same high grade material and workmanship found in all of Winkler products.

Attractive proposition to wide-awake dealers. Send for Bulletin 11 containing detailed descriptions of above Winkler products

FREDERICK WINKLER, JR. 59-61 PARK PLACE, N. Y. C.

150 BLUE PRINTED RADIO DESIGNS
OVER 100,000 SATISFIED CUSTOMERS IN 18 MONTHS

Enabling you to build your own Radio Phone Receiver or Transmitter at a 50 to 75% saving under finished instrument prices.

FEATURING
- Designs backed by actual performance
- Expert Senior Commercial Engineering
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INFALLIBLE DRAWING SYSTEM SHOWING
- Assembly Views
- Detailed Parts
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- Wiring Diagrams
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Ask for Catalog 77

CONTAINS
- Illustrations of Models built by customers
- Actual Results as related by customers
- Complete List of Blue Prints Designs
- Price Lists of Parts for each Design

Models will be on display in our New York office.
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EXPERIMENTERS INFORMATION SERVICE, Suite 2300, 220 W. 42d St., N.Y.C.

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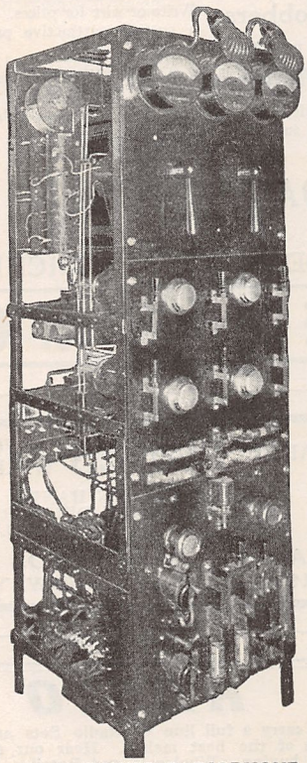
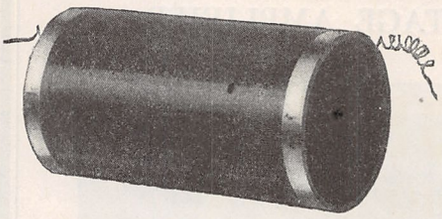


HIGH POWER RADIOPHONE AND CW TRANSMITTER BUILT FROM E. I. S. BLUE PRINTS



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UNMOUNTED

The finest, we believe on the market today

Heavy fibre tube SHELLACED (not paraffined) inside and out, 8"x4"—the size preferred by amateur radio makers.

Perfectly wound with No. 22 enameled copper wire.

Wire SHELLACED IN PLACE and the ends brought through the tube and fastened.

EQUIPPED WITH POLISHED ALUMINUM ENDS—a beautifully finished coil—preferred on sight.

Immediate Shipment

Will be made of the first 10,000 ordered. Immense capacity enables us to promise prompt shipment on orders for any quantity. Sample sent postpaid upon receipt of

$1.00

Dealers: Discount 40% f.o.b. Detroit. Order direct if your jobber cannot supply you. This is the coil that will sell fastest.

Jobbers: Write or wire for prices. We have a specially attractive proposition to make to you.

Manufacturers: We are now supplying tuning coils for large radio manufacturer. Here is a dependable source of supply for you. Wire requirements.

OAKWOOD RADIO CO.
P. O. BOX 366
DETROIT -:- MICHIGAN

PAPER **TUBES** FOR WIRELESS
ALL SIZES ON HAND
FOR IMMEDIATE DELIVERY
WHOLESALE AND RETAIL
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RADIO
We carry a full line of Radio Sets and Supplies of the best makes. Hear our sets before buying. Wholesale and Retail.
Get Our Prices
CHICAGO ELECTRICAL SUPPLY CO.
360 W. Madison St. CHICAGO, ILL.

Some have said that Theory lives in the laboratory and that Fact becomes thoroughly accredited only when it finds general applications in a practical way. The development of wireless from the theoretical to the broadcasting stage bears out the statement.

Among the diversified uses for radio broadcasting, music has held the center of the stage, with an attempt to intermingle news paragraphs, weather reports, speeches and vaudeville sketches. It has remained for Chicago's newest morning newspaper, the *Journal of Commerce,* with its following chiefly among bankers, brokers, and business men generally throughout the middle west, to strike a distinctly new note in radio telephony. Jose Bornn, famed economist and managing editor of the *Journal of Commerce,* broadcasts summaries of the paper's financial and commodity market reports personally for the world at large to hear each night at 6:30 o'clock, Chicago daylight saving time, excepting Saturday and Sunday.

Mr. Bornn is believed to be the first managing editor of a morning newspaper volunteering to tell all his subscribers and the world in general by word of mouth just what to expect in the columns of his paper the next morning, and giving a complete survey of the day's happenings in the world of finance and business.

A special value in the service lies in the fact that it covers all the great business interests of Chicago, which is the world's primary market for many commodities, such as grain, flour, livestock, hides, lard and so forth, and a distributing center of prime importance for an extensive territory for domestic and imported goods of all kinds.

The Chicago *Journal of Commerce* collects all its financial and commodity market reports and other business news through specialists of its own staff, thus printing a much larger proportion of exclusive matter than is the case with daily newspapers who are members of press associations. For this reason the newspaper in question can furnish an unusually extensive radio business news service. The summaries cover New York and Chicago stocks and bonds, money and foreign exchange; the primary and great central markets of Chicago and including also cotton, cotton seed oil, sugar, coffee and tea.

The financial service is broadcasted from the Westinghouse station KYW on a 360-meter wave, a station acknowledged to be one of the greatest in America. Mexico and Cuba have been receiving KYW's reports and already many letters of approval have been received by the versatile editor of the Chicago newspaper.

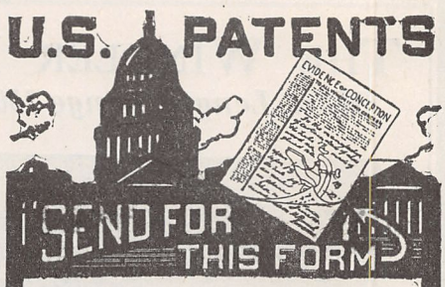
MERCHANDISING RADIO

Amazing figures, applying to the rapid expansion of popular and commercial interest in radio telephony, appear in the comprehensive survey of radio in its merchandising and advertising possibilities, prepared by Arthur Wiesenberger, Director of the Bureau of Research and Information of the National Retail Dry Goods Association.

Broadcasting stations of the 360-meter wave-length number now well over 100, an increase of more than 50 percent within less than one month. Department store broadcasting stations of this class throughout the United States have increased 100 percent within the one-month period and constitute nearly 13 percent of the total number. There are listed in the report 202 manufacturers of radio apparatus, including 34 plants producing complete receiving sets; 85 manufacturers of accessories and special units for receiving sets; 23 manufacturers of raw materials and parts used in construction of radio apparatus, and 34 manufacturers of "A" and "B" batteries and battery recharging devices.

A vast amount of literature on radio has been born, almost over night. Nine new magazines devoted to radio are listed. Numberless popular monthly and weekly publica-

U.S. PATENTS



Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

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WASHINGTON, D. C.
"Originators of form Evidence of Conception"

"I Would Not Part with it for $10,000"

So writes an enthusiastic, grateful customer. In like manner testify over 100,000 people who have worn it. Conserve your body and life *first.*

The Natural Body Brace

Overcomes WEAKNESS and ORGANIC AILMENTS of WOMEN AND MEN. Develops erect, graceful figure. Brings restful relief, comfort, ability to do things, health and strength.

Wear It 30 Days Free at Our Expense

For Children Also

Does away with the strain and pain of standing and walking; replaces and supports misplaced internal organs; reduces enlarged abdomen; straightens and strengthens the back; corrects stooping shoulders; develops lungs, chest and bust; relieves backache, curvatures, nervousness, ruptures, constipation, after effects of Flu. Comfortable and easy to wear.

Keep Yourself Fit

Write today for illustrated booklet, measurement blank, etc., and read our very liberal proposition.

HOWARD C. RASH, Pres. Natural Body Brace Co.
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VARIOCOUPLERS

Wound on red fibre tubing and having 20 taps	$3.00
Same coupler wound with silk wire	3.65
Variometers	2.75
Same variometer wound with silk wire	3.40

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1221 Lexington Ave., New York City

MAILING LISTS
For Sale

6300 Radio Dealers Retail	Per M.,	$7.50
318 Radio Manufacturers		4.00
644 Radio Supply Jobbers		7.50
14000 Amateur Radio Users	Per M.,	7.50

Trade Circular Addressing Co.
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Phone Franklin 1182

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Patents, Trade Marks, Copyrights, Patent Litigation
Handbook for Inventors, "Protecting, Exploiting and Selling Inventions," sent upon request.

tions, together with all trade journals even remotely concerned with the new field of industrial and commercial activity, are devoting departments to the subject. Newspapers in all large cities and thousands in smaller centers feature radio information for the general public.

The National Retail Dry Goods Association survey, entitled "Radio Merchandising in Department Stores," covers radio's industrial and commercial development to date. The keynote throughout is that radio can be made commercially profitable only in so far as the merchandising of it is conducted on the basis of consistent, practical service to the entire community.

Of all merchandise, the foreword points out, radio is essentially a service business. Radio equipment is so varied in nature and use, the radio art is still so largely in process of development, and the instruments required are of construction and adjustment so delicate that stores which would successfully deal in radio goods must be prepared to give real service and to stand behind the merchandise sold. Knowledge of the principles of radio telephony and a sales force especially intelligent and trained are indispensable.

The survey informs the merchant fully as to the underlying principles and supplies the latest data compiled with regard to radio in its national aspects. The directory lists all broadcasting stations licensed by the Government to broadcast, on a 360-meter wavelength, news, music, lectures, market reports and time signals; and it lists, besides, amateur stations broadcasting intermittently, and occasionally with special programs, on 200 meters.

These latest figures make it evident that radio is not only past the 100-station mark, but is well advanced in the second hundred. The 360-meter stations listed number 105. In the Atlantic seaboard states there are 28 stations of 360 meters; in the Middle West there are 36; in the Pacific Coast states, 36, and in the Gulf states, 5.

Of these Government-licensed stations, 14 are maintained by department stores; 10 by newspapers, and 7 by universities and colleges, with Ohio State University and the University of Iowa maintaining each a 200-meter station. The 360-meter stations include even one church—the Church of the Covenant in Baltimore, Maryland.

From the merchandising standpoint, the number, character and location of these broadcasting stations are of major importance because, as the survey observes:

"If a broadcasting station is located in your city, the sale of all kinds of radio goods will be very brisk and you can count on at least one in every 20 families owning a receiving set within the next 5 or 6 months. If a broadcasting station is not in your immediate vicinity, the sale of crystal sets"—ranging in cost from $15 to $40 and receiving up to 25 miles—"will not be at all practical. Only the higher-priced vacuum tube and amplifying sets, ranging in price from $75 upward, must be counted on.

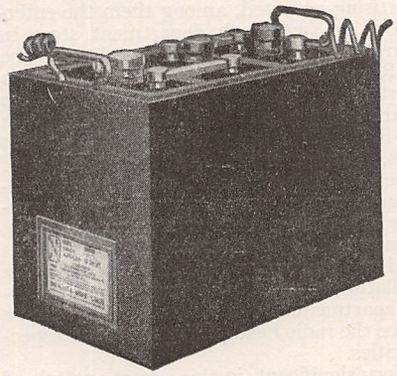
"Cities having 360-meter stations include:

"Atlantic Seaboard: Maine—Auburn, 1; Massachusetts—Boston, Medford Hillside and Springfield, 1 each; Connecticut—Greenwich and New Haven, 1 each; New York—New York, 3; Ridgewood, 1; Schenectady, 2; New Jersey—Jersey City, 1; Newark, 3; Pennsylvania—Philadelphia, 3; Maryland—Baltimore, 1; District of Columbia—Washington, 4; Virginia—Norfolk, 1; North Carolina—Charlotte, 1; Georgia—Atlanta, 2.

"Middle West: Pennsylvania—Clearfield and McKeesport, 1 each; Pittsburgh, 2; West Virginia—Charleston and Huntington, 1 each; Ohio—Akron, Cincinnati, Dayton, Granville, Toledo and Zanesville, 1 each; Indiana—Anderson and Indianapolis, 1 each; Illinois—Chicago, 2; Tuscola, 1; Wisconsin—Madison and Milwaukee, 1 each; Minnesota—Minneapolis, 2; St. Paul, 1; Nebraska—Lincoln and Omaha, 1 each; Missouri—Kansas City, 2; St. Louis, 4; Kansas—Emporia, Manhattan and Wichita, 1 each; Tennessee—Memphis, 1.

To Get the Most from Your Radio Set Use "A" and "B"

WESTINGHOUSE RADIO BATTERIES



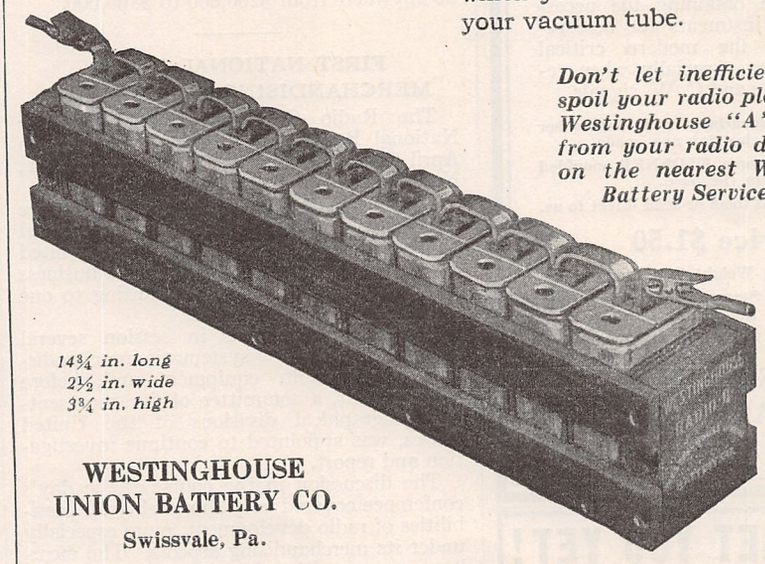
"The best Westinghouse can build"

The Westinghouse "A" is a special radio battery, made with a heavy plate and separator to insure long life. It furnishes just the type of strong, steady, constant current of low voltage that radio reception needs. It will stand continuous use without getting "tired."

The Westinghouse "B" is the best answer yet found for "B" battery problems. With occasional recharging it will be constantly full of energy and will last indefinitely.

It is noiseless, clarifies the signals, does not polarize. Its adjustable contact gives adjustable voltage by which you can take the howl out of your vacuum tube.

Don't let inefficient batteries spoil your radio pleasure. Get Westinghouse "A" and "B" from your radio dealer or call on the nearest Westinghouse Battery Service Station.



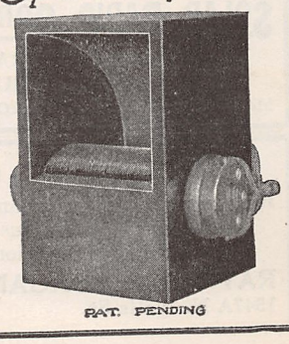
14¾ in. long
2½ in. wide
3¾ in. high

WESTINGHOUSE UNION BATTERY CO.
Swissvale, Pa.

Spirola TRADE MARK

Most beautiful loud speaker made, cabinet type, fine proportions and finish. A real ornament for the home—*horn type speakers will soon be classed with "tin horn" phonographs.* Only 8 in. high, yet the 23-in. **SPIRAL** sound chamber gives **SPIROLA** the rich tone of finest phonographs. Uses both phones of your headset—unsurpassed for loudness. At most dealers. If not at yours yet we'll send one postpaid.

"Spirola Speaks"



PAT. PENDING

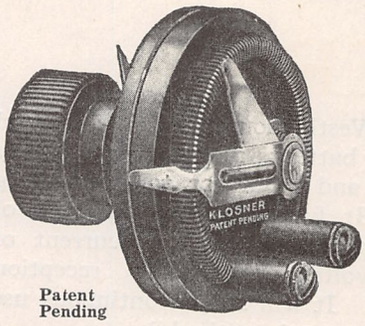
$3.85

L. H. DONNELL MFG. CO. Box 70 Ann Arbor, Mich.

MAKE NO MISTAKE!

The

Klosner Vernier Rheostat



Patent Pending

is the only Vernier Rheostat made having the exclusive feature of using but

ONE SINGLE KNOB

for both rough and fine adjustments. This feature allows the symmetrical appearance of the single knob to be retained when mounted on a panel with other instruments, and at the same time adds to the simplicity and ease of operation in obtaining the necessary fine adjustments for best results from the modern critical vacuum tubes, especially when receiving phone and C. W. signals.

We invite comparison with any other filament rheostat now made.

Look for the name KLOSNER moulded on the base.

Your Dealer has them or send direct to us.

Price $1.50

Shipping Weight One Pound

A Two Cent Stamp Brings Interesting Literature.

Made Only by The Originators

The KLOSNER IMPROVED APPARATUS CO.

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WE'LL GET YOU YET!

Brooklyn's Complete Stocked Stores of Radio Sets and Accessories

SOLAR RADIO CORPORATION

2 Stores { 532 NOSTRAND AVE. / 879 FLATBUSH AVE.

Mail Orders—Dept. R. BROOKLYN, N Y.

RAY-DI-CO

Radio Supplies for Service and Satisfaction

Write, wire or phone us for prices and information.

RAY-DI-CO ORGANIZATION

1547A N. Wells St. Chicago, Ill.

"Pacific Coast: Colorado—Denver, 1; California—Hollywood, Long Beach, Los Altos, Pasadena, Sacramento, San Jose and Sunnyvale, 1 each; Modesto, Oakland and Stockton, 2 each; San Francisco, 3; Los Angeles, 12; Oregon—Hood River, 1; Washington—Seattle, Tacoma and Yakima, 1 each; Spokane, 2.

"Gulf States: Louisiana—Shreveport, 1; Texas—Austin, Dallas, Fort Worth and Houston, 1 each.

"One of the most important divisions of the survey is the department devoted to radio advertising which, while it expounds in full the principles of radio publicity as applied to newspaper advertising by retail merchants, by no means is restricted to the field of daily advertising. The fact that more than 5,000 newspapers are now carrying daily radio news features leads the chapter on advertising, and serves to point to the consideration that remarkable opportunities exist, in the news and advertising columns, for the exploitation of original ideas.

"Noteworthy instances of striking radio advertising are cited, among them the enterprise of a New York department store in featuring Jack Binns, the wireless hero of the S.S. Republic wreck, as a lecturer in its radio department. Examples of striking radio page ads are reproduced. Brief reviews are given of radio contests, inaugurated by department stores, that seized and held the attention of the public. The manner in which store broadcasting has been linked up with local newspaper advertising receives detailed attention, accompanied by illustrations. And emphasis is laid on the effective publicity attending the installation of broadcasting stations by various department stores, several having become at once the radio headquarters in their respective cities.

"Very significant, in this expert analysis of the radio field under its commercial aspects, is the statement of the report that the annual volume in each of many among the large Eastern department stores promises to be anywhere from $200,000 to $500,000."

FIRST NATIONAL RADIO MERCHANDISING CONFERENCE

The Radio Conference, called by the National Retail Dry Goods Association on April 18, was held in the Hotel Pennsylvania, New York.

Those in attendance at the Conference represented 500 department stores located chiefly in the Eastern part of the United States and doing a yearly volume of business in department store lines amounting to one and one half billion dollars.

The Conference was in session several hours, discussing the systematic merchandising of all radio equipment and, before adjournment, a committee of five representing geographical divisions of the United States, was appointed to continue investigation and report.

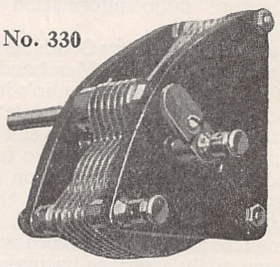
The discussion in the course of the day's conference covered very thoroughly all possibilities of radio development, more especially under its merchandising aspects. The members present felt that the new, popular science presents wonderful business opportunities, although all were fully informed as to the difficulties of supply and demand prevailing at present.

There was general recognition of the fact that the business of supplying radio equipment must undergo radical changes; that the existing enormous demand may slacken and, again, that the entrance of new producing concerns may create a surplus of supply.

It was the sense of the meeting that the department store is definitely needed for the full development of radio because only those business enterprises which are well established, large in their operation and complete in their resources, are qualified to handle it on the scale of greatness and thoroughness which it requires. Every opinion expressed emphasized the consideration that the sale of all radio material must be essentially a

HORNE RADIO Products

No. 330



The Famous No. 330 Series

VARIABLE CONDENSERS

Straight line capacity variation with the large area eccentric plate.

HORNE LABORATORY TYPE CONDENSERS are enclosed in handsome nickel-plated brass cases

HORNE MANUFACTURING CO.

General Offices:
HUDSON TERMINAL BUILDING
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HORNE RADIO

Factory:
Mercer and Colgate Streets
JERSEY CITY
N. J.

Distributed by Leading New York and Boston Jobbers and by

DeVeau-Bartling Co. ..... Detroit
United Radio & Electric Co. ..... Chicago
Hartzell Sales Co. ..... Huntington, W. Va.
O. B. Radio Co. ..... Omaha
Carter Electric Co. ..... Atlanta, Ga.
Atlantic Radio Sales Co. ..... Dallas, Texas

"RADIO TELEPHONY FOR AMATEURS"

By STUART BALLANTINE

Formerly Expert Radio Aid U. S. N.

is the book that tells the how and why of radio telephony. Written so you can understand it fully. The biggest help to the amateur operator. 200 pages, freely illustrated.

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Standard, Contact, Binding Post, Switch Stop, and Other Specials

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Brass or Steel — Plain or Plated

Accuracy! Quality! Service!

Main Office and Plant: Yardley, Pa.
New York: 117 Leonard St.
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ROLLER-SMITH

Ammeters, Voltmeters and Thermal Ammeters are wonderfully accurate and reliable. Bulletin No. V-10 describes them. Send for it—it's FREE.

ROLLER-SMITH COMPANY

15 BARCLAY STREET, NEW YORK.

Offices in Principal Cities in United States and Canada

service-giving business. It was pointed out that, where some receiving sets may be of a standard qualified to satisfy every demand on the part of the public, others may not give the satisfaction which stores of the standard of those participating in the conference must always provide, whatever the merchandise. It was agreed that any store handling radio merchandise must be prepared to know all about that merchandise and to stand behind it once it has been sold.

After adjournment, Lew Hahn, the Managing Director of the National Retail Dry Goods Association, remarked that radio is a merchandising undertaking and that the Association does not merchandise. It may be necessary, he added, to organize, outside of the Association, a separate corporation which can take charge of the general merchandising aspects in the interests of the public as well as of merchants.

The Investigating Committee recognized that because the radio telephone is so recent a development and because the growth of the business has inflamed the imagination of manufacturers and public alike there is a serious danger to the good-will of stores handling radio goods. A well-planned and developed radio receiving set placed in the hands of the amateur user at a reasonable price should make for good-will for manufacturer and retailer alike, but it is evident that much of the radio merchandise offered for sale is of the cheapest and flimsiest quality. Stores dealing in such merchandise must expect the inevitable crop of dissatisfactions likely to spring up in the wake of such business.

As its first recommendation the Investigating Committee adopted a resolution:

"That all responsible manufacturers be requested to standardize the efficiency of their various receiving sets and plainly mark on each instrument the receiving radius under average atmospheric conditions."

Such a step taken by reputable manufacturers it is believed will have the effect of making the amateur purchaser of a radio set understand what can be expected of the particular type of instrument that he buys. Such action should also have the effect of bringing an improvement in the efficiency of all such instruments.

The investigating Committee believes that all efforts possible should be put forth to conserve the confidence of the public in the radio telephone at this time while the demand is still new in order that the business may develop steadily without serious set-back.

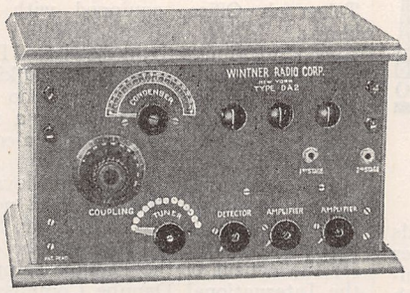
NEW MEANS OF PUBLICITY

The Universal Film Corporation has equipped an automobile with a complete wireless set, antenna "and everything," the driver making his rounds slowly through the Loop during congested hours, thereby attracting thousands of curious people and greatly adding to the troubles of the traffic policemen.

ADVANCE IN RADIO WORK IN CZECHOSLOVAKIA

Czechoslovakia is soon to have a central and subsidiary wireless system, according to a report from C. S. Winans, American Consul at Prague. The Ministry of Post and Telegraph of Czechoslovakia has followed all the latest developments in radio, sending engineers to foreign countries to study operating systems. When weather conditions are favorable, a large station will be built at Podebrady, Bohemia, where the natural features are said to be ideal.

The main station will be equipped with high frequency generators (Letour-Bethenod type) producing 50 KW. in the antenna. The entire station will be able to produce additional energy up to 100 KW. at the antenna. If the work demands it an additional 50 KW. set will be installed. Two towers 150 meters in height will be erected. It is estimated that the radius of action will be about 4,000 kilometers.



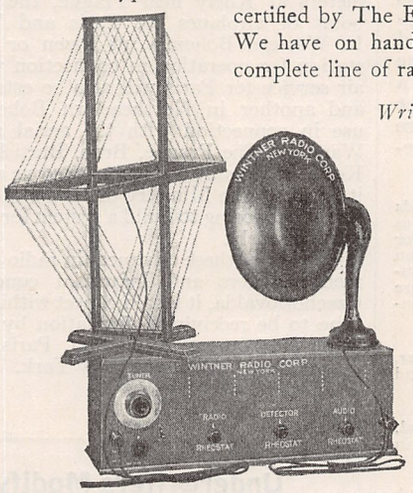
THE EVENING MAIL RADIO INSTITUTE
Certificate of Excellence
THIS IS TO CERTIFY that the Vacuum Tube Receiver manufactured by the Wintner Radio Corp., New York, N.Y. has been tested in the Laboratory of THE EVENING MAIL RADIO INSTITUTE. It has been found that the instrument agrees with the standards set by the Institute. The materials used in its construction are of a quality commensurate with the price and the design is based upon sound engineering practice.

DEALERS!

OUR VACUUM TUBE RECEIVER is considered by experts to be the finest receiver on the market for the price. It is made of splendid materials throughout, is beautifully finished, B-Batteries in cabinet, with set of matched sensitive phones, and is a great favorite with radio enthusiasts. Another popular number is our Loop Aerial Set which proved the most efficient of all types exhibited at the Newark Radio Show. Both these sets are certified by The Evening Mail Institute.

We have on hand, ready for immediate delivery, a complete line of radio equipment and parts.

Write for full particulars.



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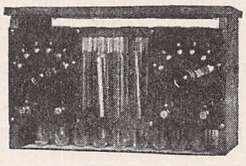
LABORATORY RWC CERTIFIED
WINTNER RADIO CORP
115 W. 30TH ST., N.Y.C.
Manufacturers and Distributors

WINTNER RADIO CORP.

115 West 30th Street, New York Phone: Watkins 0373-0374



STORAGE BATTERIES

Designed Especially For

WIRELESS

KICO nickel-iron type alkaline storage "B" batteries have long since passed the experimental stage. The purchase of one will solve your "B" battery troubles for years to come. They are not harmed from short-circuiting, overcharging or standing idle, last from three to six months on one charge and can be recharged from A.C. with rectifier furnished with each battery. Money back if unsatisfied within 90 day trial. Plain batteries with clips for adjustment 22 volts, $6.50; 32 volts, $8; 48 volts, $10; 68 volts, $12. Batteries with panels and switches for adjustment as per cut, 32 volts, $12; 48 volts, $14; 68 volts, $17.

For "A" battery comfort buy a KICO 60 A. H. battery complete with rectifier to charge from A.C. at the following prices: 6 volt, $19; 8 volt, $22; 10 volt, $25. Literature gladly furnished.

KIMLEY ELECTRIC CO., 290 Winslow Avenue, BUFFALO, N. Y.

MONEY for You Add to your Salary—Make extra Pin Money. Start a lucrative business of your own. Spend an hour each day taking subscriptions for the "Radio News." We'll pay you well and you'll enjoy the work. Write for full particulars. **Circulation Dept., RADIO NEWS, 53 Park Place, New York City.**

THE Teagle LINE

When you see the name TEAGLE on a radio instrument you know that it is a *better* piece of apparatus. Send for catalog.

THE NEWMAN-STERN CO-CLEVELAND, OHIO

Imitations!

NAA Arlington tested Detector Crystals have won their reputation through sheer goodness—through their marvelous and uniform sensitiveness—by the honesty with which they are tested, packed and guaranteed.

That there should be imitations of these nationally famous minerals is to be expected. We welcome fair competition. But unscrupulous imitations are unfair both to you, the user or dealer and to us, the pioneer producers of tested crystals.

Certain unscrupulous manufacturers are marketing so-called tested minerals in packages closely resembling the famous NAA containers. We have obtained and tested dozens of these so-called tested crystals—some are without a sensitive spot on their surface—others are of mediocre quality—not one meets the rigid requirements of our testing laboratories.

We sell *sensitiveness*, not bulk minerals. Pounds of crystals are worthless—Galena, for instance, is cheap—the market price is less than 3c. a lb. For crystals worthy of efficient radio use insist upon the genuine NAA (Arlington tested) Detector Crystals. For your own protection look for the signature of J. S. NEWMAN, the originator, on every container. It will insure *guaranteed* sensitiveness.

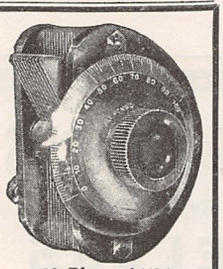
Each is packed in lithographed metal container. The mounted crystals are set into brass cups and packed in enameled turned wood boxes.

NAA Galena, Silicon or Goldite, price per crystal, postpaid, $0.25. Mounted, set in woods, metal in brass cup, price per crystal, postpaid, $0.40.

We will gladly replace without charge any NAA Crystal that does not function to the entire satisfaction of the user. Send for complete 80-page radio catalog describing these crystals; The Teagle Line; "Red-Head" Radio Receivers and all the leading makes of Radio equipment. The Newman-Stern Company, Cleveland, O.

"RED-HEADS"
THE LAST WORD IN RADIO RECEIVERS
at your dealers or send direct to
The Newman-Stern Co.
CLEVELAND, OHIO.

A Step Forward in
VARIABLE CONDENSERS



Concealed Counterweight Brass Studs Through Aluminum Plates and Die Cast Shaft Held in True Center Through Brass Bushings; Binding Posts on Separate Metal Straps: No Insulating Material Tapped — Brass Inserts Throughout.

23-Plate, $4.25
43-Plate, $4.75
Complete with Knob, Dial and Counterweight
Mfd. by
Radio Stores Corp.
Pat. Pending. Type VC-1

Dictograph Head Sets
Light in Weight, Clear in Tone. Finest Construction and Finish $12.00
Jobbers We have an interesting proposition for you on these items
RADIO STORES CORPORATION
222 W. 34th Street, New York City

Podebrady station will be the main sending station for Prague, but a small station will also be erected there by the State Post and Telegraph Office, equipped with electron lamps.

At Kral Vinohrady, a district of Prague, a radio station with a radius of 400 kilometers is now being operated. At Brno (Brunn) Moravia, a radio plant having a range of 1000 to 1500 meters has just been completed and tested.

For communication between Slovakia and Prague as well as the Orient, a new radio station is being erected at Kosice, Slovakia, and another at Bratislave will be operated for the benefit of the Danube shipping and the International Danube Commission now sitting there.

A radio sending and receiving station has been projected for Liberec (Reichenberg) and it is hoped that it will be completed by August 20. The State Telegraph Office at Karlovy Vary (Carlsbad) also contemplates the erection of a small station there before the season at the baths opens.

Because of the importance of radio communication to aerial navigation, the Czechoslovak Ministry of Post and Telegraph and the Ministry of National Defense are now building a station with a range of 1000 kilometers at Kbely near Prague, the starting point of airplanes for Paris and Warsaw. In Western Bohemia, at Plzen or Cheb a station for operation in connection with the air service for Paris will also be established, and another in Northeastern Bohemia for use in connection with the aerial route to Warsaw. The Prague, Brno, Bratislava and Kosice radio stations will also serve air fleets, it is said. The Ministry of National Defense is now proposing to build a system for military purposes only.

In view of these advances in radio development bankers and industrial concerns in Czechoslovakia, it is said, expect within a short time to be receiving information by wireless from the bourses of London, Paris, Berlin, Zurich, Amsterdam and New York.

Underwriters Modify Radio Regulations

(*Continued from page* 31)

Splices and joints in the antenna span, unless made with approved clamps or splicing devices, shall be soldered.

Antennae installed inside of buildings are not covered by the above specifications.

Lead-In-Wires

b. Lead-in-wires shall be of copper, approved copper-clad steel or other approved metal which will not corrode excessively, and in no case shall they be smaller than No. 14 B. & S. gage except that approved copper-clad steel not less than No. 17 B. & S. gage may be used.

Lead-in-wires on the outside of buildings shall not come nearer than four (4) inches to electric light and power wires unless separated therefrom by a continuous and firmly fixed non-conductor that will maintain permanent separation. The non-conductor shall be in addition to any insulation on the wire.

Lead-in-wires shall enter building through a non-combustible, non-absorptive insulating bushing.

Protective Device

c. Each lead-in wire shall be provided with an approved protective device properly connected and located (inside or outside the building) as near as practicable to the point where the wire enters the building. The protector shall not be placed in the immediate vicinity of easily ignitible stuff, or where exposed to inflammable gases, or dust, or flyings of conbustible material.

RADIO HEAD PHONES

World's Largest Distributors of

Radio Head Pieces

We represent 30 manufacturers, showing 75 types and designs, priced from $5.00 to $15.00. Following is a partial list of manufacturers:

Manhattan — Cory
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Dictagraph — Elmwood
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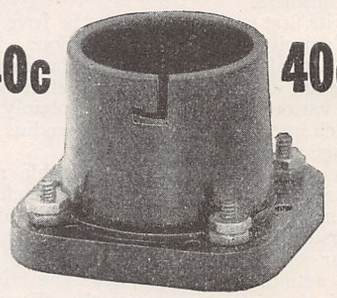
Phones on hand for immediate shipment. Ask us for the phone you want. **Special**—100-ohm single receivers made by old reliable telephone maker. List.....$2.50
Agents Wanted Everywhere. Get literature and discount sheet.

B. E. POLCZYNSKI & CO.
107 Capitol Bldg. — 1550 Broadway
Detroit, Mich. — U. S. A.

40c  40c

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A moulded bakelite socket that cuts the cost of radio.

Attractive discounts to dealers.

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Immediate deliveries assured

VOLUTONE

The Newest Thing in Radio. Phonograph Cabinet and Loud Speaker Combined. Assemble present or any standard equipment in this compact cabinet. Proved demand. Deliveries NOW. *Dealers*—Write quick for prices on this fast seller.

THE VOLUTONE COMPANY
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RADIO FREE CATALOG

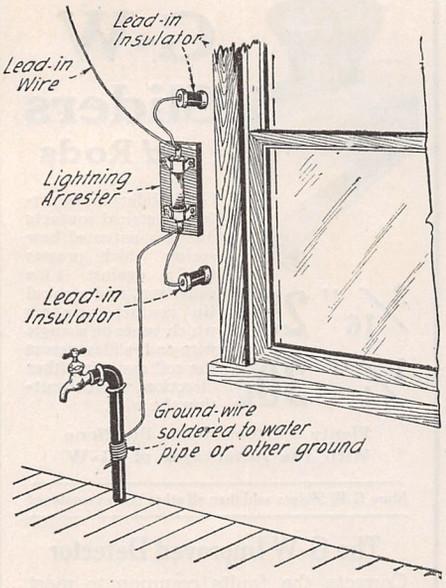
Illustrating complete sets, Westinghouse, Grebe, Remler and other standard makes. Parts to make your own set, Antenna wire, Head sets, latest books. Sixty years in business.

JULIUS ANDRAE & SONS CO.
117 Michigan St. — Milwaukee, Wis.

BALDWIN PHONES

made into LOUD speakers. I will supply Horn and Box, price reasonable. BALDWIN PHONES repaired, adjusted, tuned and new diaphragms put on. Wireless receiving sets built to order, repaired, etc.

Established 1910
J. F. ARNOLD, 109 E. 125th St., N. Y.



Showing how an automatic lightning arrester should be connected

The protective device shall be an approved lightning arrester which will operate at a potential of five hundred (500) volts or less.

The use of an antenna grounding switch is desirable, but does not obviate the necessity for the approved protective device required in this section. The antenna grounding switch if installed shall, in its closed position, form a shunt around the protective device.

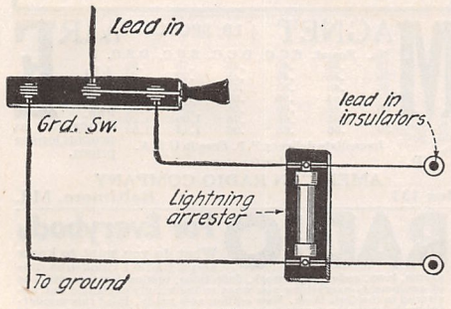
Protective Ground Wire

d. The ground wire may be bare or insulated and shall be of copper or approved copper-clad steel. If of copper, the ground wire shall be not smaller than No. 14 B. & S. gage, and if approved copper-clad steel it shall be not smaller than No. 17 B. & S. gage. The ground wire shall be run in as straight a line as possible to a good permanent ground. Preference shall be given to water piping. Gas piping shall not be used for grounding protective devices. Other permissible grounds are grounded steel frames of buildings or other grounded metallic work in the building and artificial grounds such as driven pipes, plates, cones, etc.

The ground wire shall be protected against mechanical injury. An approved ground clamp shall be used wherever the ground wire is connected to pipes or piping.

Wires Inside Buildings

e. Wires inside buildings shall be securely fastened in a workmanlike manner and shall not come nearer than two (2) inches to any electric light or power wire unless separated therefrom by some continuous and firmly fixed non-conductor making a permanent separation. This non-conductor shall be in addition to any regular insulation on the wire. Porcelain tubing or approved flexible tubing may be used for encasing wires to comply with this rule.



If a ground switch is used it should be connected in parallel with the arrester as shown here

Price $5.00 Complete

HIPCO Multiphone

PATENT APPLIED FOR

PRICE $5.00 COMPLETE WITH 4 SETS OF HEAD PHONES

The Wonder of the Radio Industry

Let your friends and family listen in—Reproduction perfect. No trouble—Nothing to get out of order

The Hipco Multiphone enables you to purchase four pair of receivers for less than the price of one. Reproduction 100% perfect—no trouble—absolutely nothing to get out of order. Your family or your friends may now enjoy radio concerts, lectures, etc., with perfect ease and comfort to all.

The Multiphone may be used in connection with any receiver. Simply place one of your receivers face down on Hipco Multiphone and draw the elastic bands over back of receiver to hold it firmly. The Multiphone will do the rest in a most pleasing manner. The extension tubes are all four feet (4 ft.) long.

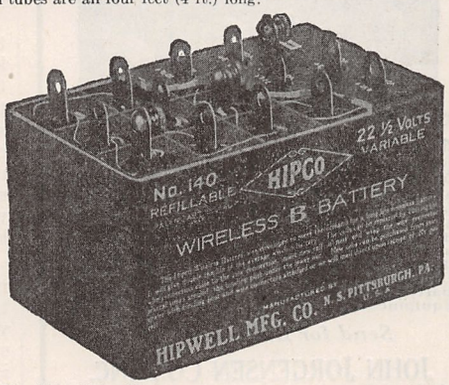
HIPCO

Wireless B Battery

Refillable Variable

Refillable and variable B Battery especially designed for Vacuum tube work on plate circuits, is guaranteed to be perfectly noiseless; it will give double the life of the ordinary battery.

The above cut shows part of the cover cut away which illustrates the convenience in inserting a new cell should one prove defective. These replacements are furnished complete with a positive and negative terminal soldered fast, and will be sent to any address upon receipt of 25c. They can be inserted without the use of soldering iron if desired.



No. 100—Volts 22½ ..... Price $3.00
No. 140—Volts 22½ ..... Price 2.00
Size 4½—x2½—x2½

BOOSTER OR SECTIONAL B BATTERIES

No. 110—Volts 4½ Size 4—x2⅜—x1½" Price $0.65

No. 130—Volts 4½ Size 2½—x2½—x ⅛ Price $0.45

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HIPWELL MANUFACTURING CO.

No. 825-835 NORTH AVE. N. S. PITTSBURGH, PA.

GOTHAM VARIABLE CONDENSERS

.0005 mfd., $5.00 .001 mfd., $5.50

A "straight line" condenser which gives better tuning as the increase and decrease of capacity moves in even gradations. Scientifically designed and properly constructed.

Quality Equipment

DAVID KILLOCH COMPANY 57 MURRAY STREET NEW YORK CITY

FOUNDED 1907

MONEY FOR YOU—Add to your salary—Make extra pin money—Start a lucrative business of your own. Spend an hour each day taking subscriptions for the Radio News. We'll pay you well and you'll enjoy the work. Write for full particulars. Circulation Dept., Radio News, 53 Park Place, New York City.

RECEIVING JORGOTONE SETS

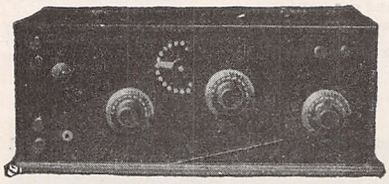
Jorgotone Supreme

A DETECTOR and two-stage amplifier built into a beautiful genuine mahogany cabinet with separate compartment for storage and "B" Batteries. Panel is made of "Mahoganite" and has mounted on it: **2 Variometers, 1 Variocoupler, detector and amplifier controls, rheostats, transformers, dials, binding posts, jacks, plug, etc.**

Price $165.00

Complete with tubes, storage battery, "B" Batteries, 'Phones, Loud speaker and Antenna Equipment. $235.00

Jorgotone Superior



A complete vacuum tube receiving set arranged for close, selective tuning. Set is contained in a finished, rubbed, dark, heavy quartered oak cabinet and comprises a "Mahoganite" panel 8"x21½" with following parts mounted thereon: **Variocoupler, 2 Variometers, socket, rheostat, dials, jacks, plug, binding parts and in-put and out-put for the addition of a 2-stage amplifier. Price $70.00**

Complete with tube, storage Battery, "B" Battery, Phones and Antenna Equipment..... $105.00

Send for Bulletin R. N.

JOHN JORGENSEN CO., INC.

120 Liberty St. (Est'd 1912) **New York**

RADIO DEALERS MANUFACTURERS

Attractive prices and prompt deliveries on coils, parts and completed receiving sets.

Tuning Coils

Secondary Coils

Vario-couplers
Primary Coils
Rotors

Coils Wound to Order

Beautifully finished and efficient complete sets from .... **$1.25 to $35.00**

Write for Price List

Ra-Tone Electric Co. **716 Park Place West**
Radio Department **Detroit, Mich.**

ANTENNA WIRE

Special 100 Ft. No C.O.D.

7-20 Bare	.95;	Tinned 1.10	Delivery	
7-22 Bare	.60;	Tinned .65	3 days	
14 Solid, Bare	.44;	Tinned .48	P. P. Free	

AMERICAN RADIO COMPANY
Box 133 Baltimore, Md.

Receiving Equipment Ground Wire

f. The ground conductor may be run inside or outside of building. When receiving equipment ground wire is run in full compliance with rules for Protective Ground Wire, in Section d, it may be used as a ground conductor for the protective device.

Regulations covering sending stations have also been drawn up and copies may be secured from the National Board of Fire Underwriters.

One of the fire dangers connected with the present radio craze is the inclination of those interested to experiment with lighting circuits and other high voltage systems. It is reported that not long ago three children at Aiken, South Carolina, were burned to death in a fire resulting from a short circuit in a radio transformer, and a New Jersey boy carelessly crossed the leads from his storage battery and started a fire that might have become serious, if it had not been promptly detected. It is because of such dangers that the National Electric Code requires all wiring to be in accordance with class of installation. The work should always be inspected before being placed in service.

Construction of a Tungar Rectifier

(*Continued from page* 58)

The core and windings can now be assembled. Slide a core leg through each coil, place them side by side, 2½" apart, and slip in the short laminations to form the ends, being careful to alternate and get the ends even.

To clamp the core, cut the strap iron into two lengths 6½" long and another two lengths, which will be long enough to clamp the side legs and extend downward so that they may serve as feet when bent. Through suitable holes drilled in the ends of the clamps, sufficient pressure can be obtained by using the machine screws to prevent excessive noise caused by the laminations vibrating, which is often the cause of a transformer heating up.

It is a good plan to make a panel for the rectifying apparatus on which can be mounted the D. P. S. T. switch for turning the 110 volts off from the transformer. The lamp socket, which is to mount the tungar bulb, is placed in the back of the panel on a little ledge. The transformer can be fastened, by means of the legs and some wood screws, to the base of the panel. The ammeter should be placed on the top of the panel where a watchful eye can be kept as to its operation. For making contact to the plate of the tungar bulb, an ordinary clip can be used. A diagram of connections is shown in Fig. 2. All wiring should be done with No. 14 D. C. C., as the current used is quite heavy.

Some hints as to its operation would probably be appreciated. Be sure that the lamp socket used is of porcelain, as the heat is great enough to fuse light brass when used at long stretches. Do not be alarmed if the tube elements are seen to be red hot when in operation; the tube is specially built for low voltage high current rectifying. The windings will also run warm, but operating properly, the windings should not get so hot as to scorch the insulation. If, when the ammeter is connected, it shows discharge, then by reversing the connections, it will show charge. Always have the ammeter in the positive lead.

For the benefit of those who feel that an instrument of greater charging capacity than two amperes, as described above, is wanted, a larger tungar bulb can be used of the five-ampere type. In this case, instead of No. 14 D. C. C. wire on the Secondary, No. 12 D. C. C. will have to be used.

As the tube is designed to carry only two amperes—at the most, three amperes—it will be found that, when starting to charge a discharged storage battery, it will draw more current than the tube will carry. To prevent

G-W Sliders and Rods

G-W Sliders make perfect electrical contacts due to a patented bow spring which presses firmly against the slider rod, and a spiral tip contact spring which tunes on a single wire and slides across the coil easily in either direction, without cutting the wire.

3/16" 25c

1/4" 30c

Plenty of Other Sliders But None With the Advantages of G-W

More G-W Sliders sold than all other makes combined

The G-W Improved Detector

Corrects the faults common to most detectors. Position will not loosen after setting. Entirely new design of crystal cup—no screws—locks automatically. Mechanically and electrically perfect. Up to the usual G-W Quality Standard.

—DISTRIBUTORS WANTED—

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Manufacturers of G-W RADIO PRODUCTS

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And Other Electrical Inventions Patented

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PATENT LAWYERS

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We have with us four late members of the examining corps of the United States Patent Office.
Other offices: New York, Chicago, Denver, Seattle.
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$3.50 RAC $3.50

AMPLIFIER CHOKES

For Use With

RAC-3 AUDIONS

NEW JERSEY RADIO EQUIPMENT & INSTALLATION CO.

120 Bidwell Avenue Jersey City, N. J.

C. W. APPARATUS OF ALL KINDS

Detector and One-step Amplifier in cabinets..... $35.00

C. W. Chemical Rectifiers, complete, 500 mill-amp. Cap. 14 jars, will handle ½ amp. at 1,000 volts or less. In cabinets..... 9.50

Prompt shipment

JONES ELEC. & RADIO MFG. CO.

120 E. Lexington St. Baltimore, Md.

MAGNET WIRE

½ LB. SPOOLS

No.	Enaml.	S.C.C.	D.C.C.	S.S.C.	D.S.C.
18	.32	.40	.45	.70	.80
20	.35	.45	.48	.72	.84
22	.40	.52	.56	.74	.90
24	.44	.58	.60	.78	1.05
26	.48	.60	.66	.90	1.15
28	.53	.66	.78	1.00	1.20
30	.56	.88	.96	1.14	1.50

½ lb spools 46% less. Other sizes at proportionate prices.

1 lb. spool add 90%

Immediate delivery P.P. Free in U.S.A.

No C. O. D. *Circular for stamps.*

AMERICAN RADIO COMPANY

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RADIO For Everybody

What do you want to know about Radio? Hook-ups, diagrams, laws, codes, code-work, definitions, testing instruments, use of equipment--everything you want to know fully explained and answered in the Quiz Book. New edition now ready. Read this wonderful book for the best way to use your equipment, instruments--or to prepare for Government examinations for Operator's license, etc., etc. Price only $1.00. Money-back guarantee. Send for it today.

National Radio Institute, Dept. 1101, Washington, D.C.

this, a resistance of salt water inserted in series with the primary will lower the charging current. By adding more or less salt, the current can be regulated easily.

The above charger is designed to charge a six-volt battery, although, if necessary, it can be made to charge a 12-volt storage battery. I will be pleased to answer any inquiries as to its construction or operation.

The Modulation Method of C. W. Reception

(*Continued from page* 58)

Fig. 2, in which two or three stages of radio frequency amplification are used, permitting the reception of European and other transoceanic stations on small loops 15″ and 20″ square. The radio frequency amplifier is of the resonance type composed of tuned circuits which provide a greater sensitiveness than other systems, but require a finer adjustment. As may be noted in both circuits, no plate battery is used with the modulator tube. This has been found unnecessary, and does not improve the results.

Fading

(*Continued from page* 67)

this last statement to be true.

The fading tests also reveal that a transmitting station's wave-train fades only when at a considerable distance, compared to the range of the set, from the point of transmission. That is, two stations of different strengths standing side by side do not fade at the same points, but the wave-train of the weaker station fades before the wave-train of the stronger station. The reason is that the strong waves can pass straight through a mass of cloud by which the weak waves are just refracted.

Radiophoney Broadcasting Schedule for Tonight

By ROBERT WEIDAW

A O H

1,000,000 Meeters

7:00 p. m.—Mrs. Sharpe-Shears will give a very brief talk on "The Wave-Length of Bobbed Hair."

7:30 p. m.—Bedtime Stories by Mat Tress.

8:00 p. m.—Mr. C. Dann of Fliversville will sing a very beautiful song which should be of intense interest to all Radio Bugs and Ford owners. The title of this song is "Tuning, Always Tuning."

8:00 p. m.—Barreltone solo by I. M. Thurstee: "You may take away my licker but you will not keep me still."

8:30 p. m.—Intermission for applause.

9:30 p. m.—Popular ballad by Chris Till, entitled "My Gal Lena."

10:00 p. m.—Humorous number by Michael Gilhooley:
(a) "Cohen on the Radiophone."
(b) "Aunt Enna Gets Everything."

10:90 p. m.—Dramatic Recitation of Income Tax Statistics by Miss Representation.

10:99 p. m.—A delightful romantic story on "Smith Brothers' Coughdrops" will be told by Millie Amp.

B V D

This is their weekly night in the air.

7:45 p. m.—Porousknit Sacred Quartette

Get better results from your RADIO set with the SHINN AMPLITONE

GIVES LOUDER, CLEARER SIGNALS, REDUCES STATIC AND INCREASES RANGE

You cannot imagine how loud and distinct messages and broadcasting come in over the Amplitone until you have one yourself and verify the results in actual use. Static is greatly reduced and antenna "frying," scraping and grinding noises are usually entirely eliminated. Nothing like Amplitone has ever been offered to you before.

AMPLITONE RADIO ANTENNA

"Makes the little set work well and the big set work better"

Large Capacity and Low Resistance of Amplitone Makes Your Receiving or Sending Set from 50% to 100% More Efficient

Amplitone has much greater capacity than ordinary copper wire or similar makeshifts because it is specially designed for radio use. Its flat, close woven form also affords the greatest possible conductivity to high frequency oscillations and brings in the signals without leakage.

Eliminates Cumbersome Spreaders and Special Equipment

With the Amplitone you no longer need aerial spreaders and a lot of special apparatus to erect a receiving set. A single 75-ft. length of Amplitone put up in your attic or around the moulding of your spare room will give better results than any number of copper wires or other makeshifts strung on the roof. Try it out and prove it for yourself!

Saves One Stage of Amplification

Signals over the Amplitone come in so loud that you can often dispense with one stage of amplification entirely and thus pay for your set in this economy alone right at the start. And why shouldn't it be far superior to ordinary copper wires or other makeshifts of three to a dozen strands? Amplitone is woven of 10 wires, giving 750 feet total length. That's what counts! This new discovery in antenna efficiency now brings the musical concerts, news, etc., of the big broadcasting stations within the reach of all. Set up your Shinn Amplitone and enjoy this surpassing pleasure now.

Price List

AMPLITONE SET No. 1
Contains 75 ft. SHINN AMPLITONE Antenna, two aerial strain insulators and two antenna clamps. Price..... **$6.90**

AMPLITONE SET No. 2
Contains 75 ft. SHINN AMPLITONE Antenna, two aerial strain insulators, two antenna clamps and one Protexu Lightning Arrester. Price..... **$8.60**

AMPLITONE SET No. 3
Contains 75 ft. SHINN AMPLITONE Antenna, two aerial strain insulators, two antenna clamps, 50 ft. SHINN-FLAT Ground Lead and one Protexu Lightning Arrester. Price..... **$17.60**

AMPLITONE SET No. 4
Contains 75 ft. SHINN AMPLITONE Antenna, two aerial strain insulators, two antenna clamps, 50 ft. SHINN - FLAT Ground Lead, one Protexu Lightning Arrester and one SHINN Carbon Ground. Price..... **$18.80**

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Our new booklet, "How to Get Better Results from Your Radio Set," is just off the press and will be sent free upon request.

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Get a Handy Binder for your RADIO NEWS. Holds and preserves twelve issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, New York.

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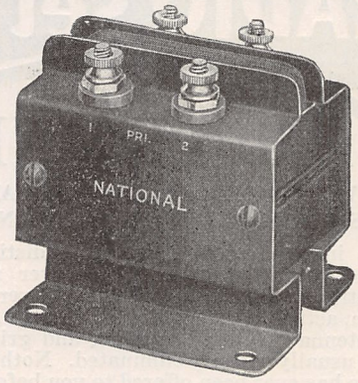
Audio-Frequency
AMPLIFYING TRANSFORMERS



THE BEST TRANSFORMER VALUE ON THE MARKET

The NATIONAL TRANSFORMER is made of the best grade materials throughout. Produces maximum amplification with extraordinary freedom from objectionable tube disturbances.

Price, as shown.....$4.00
Unmounted.....3.50

Other NATIONAL RADIO PRODUCTS that will be of interest to the trade are:

NATIONAL VARIOMETER	$5.00
NATIONAL VARIOCOUPLER	4.50
NATIONAL RHEOSTAT	1.00
NATIONAL V. T. SOCKET	.60
NATIONAL DETECTOR UNIT	6.50
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PORCELAIN BASE - BABY KNIFE

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3 inch Hard Rubber Dial	$0.90
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will render several Holy Selections. All chickens without wings might listen intently to these angelic anthems.

8:30 p. m.—The original Hatch (No Button) Quartette, composed of Henry Egg, Geo. Incubator, John Buckeye and Ulysses Plymouth, will render a mysterious number entitled, "Button, Button, Who's Got the Button?"

9:00 p. m.—Y. R. Undies will give an abbreviated talk entitled, "When to Make the Change."

Midnight—The Underwear Trio will give a number of pleasing combinations.

N O Y Z

1 to 1,000 Meters, Inclusive.

8:00 p. m.—Joint recital of Locomotive Pneumatic Hammer Sextette and Machine Gun Company, accompanied by "Flash" Steinmetz at the Lightningola.

10:00 p. m.—The Anvil Chorus of the United Horseshoers' Association will give several horse selections in Dan Patch time. You'll need no loud speaker to receive these numbers.

2:00 a. m.—Catwhisker Back Fence Duet by Kitt Kittens and Will Meyow entitled "The Awakening."

I W W

7:00 p. m.—Joint recital of Independent Order of Italian Piano Tuners. They will give only one selection which should meet your reproval. Their selection is entitled, "What'll I Do Wid Dis Cord?"

7:30 p. m.—Reading of Alphabet backwards by Quintet of Chinese Coolies.

8:00 p. m.—Lecture by I. O. Fayres of the Amalgamated Trolley Car Union on "one man" cars. The title of this talk will be "Two Heads Are Better Than One."

9:00 p. m.—Lecture, "Why They Rushed Me to Russia," by Emma Goldman.

9:01½ p. m.—Disconcerting illustrated songs by the "I Won't Work" Glee Club.

Radio in the West Indies, Central and South America

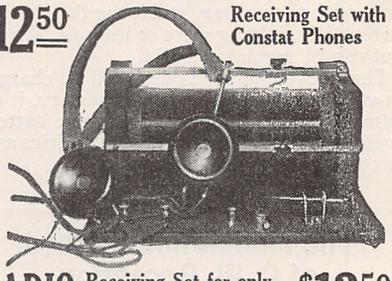
By E. C. STEPHENS

NOW that we have just passed through one of the most Historical Radio Seasons ever known, with the advent of the Radiophone and its broadcasting programs, we again look to other fields still more distant than "TRANS-ATLANTICS," or "TRANS-PACIFICS" to conquer. For during this season we have reached European stations in one jump, also our signals are being reported in Hawaii, with prospects of our American colonies in the Far East taking up the "Far Call" and passing it on to the other side of the Globe.

The new fields are not far distant—really they are right at our own back door. We have Mexico, where there are many Radio enthusiasts. Then Central and South America with the West Indies as the link between, or the outer rim of two routes to the South. All have their Radio experimenters who have hopes of some time reaching another Island or the Mainland with their signals.

This article has been written expressly to give more publicity to the ever growing field of Radio, throughout Latin America. One of the most progressive of these is Porto Rico, an exceedingly rich island of American possession, which lies about half way between the Southern part of the State of Florida and the Northern coast of South America, and offers a very wide field for the foundation of Radio communication, both commercial and amateur. Commercially there are few if any cables that run directly to the United States from the coast of Venezuela. The circuitous route taken by the cables at present cause the rates to become almost prohibitive. Venezuela has just recently opened a group of up-to-date tube stations, which are reaching out quite well. These stations handle traffic, both Government and com-

$12.50 Receiving Set with Constat Phones

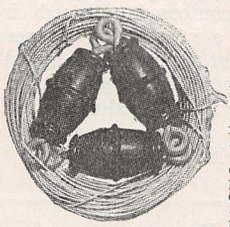


RADIO Receiving Set for only **$12.50**
Including Constat Headphones

All the wonderful entertainment of the radio programs on this dandy set. Comprises double slide tuning coil, adjustable crystal detector, condenser and Constat headphones, all connected, ready for use. Best materials, carefully made, thoroughly tested. You couldn't possibly make this set yourself for less than $15. You can get it complete for just $12.50.

If Bought { SET . . . $7.00 } Outfit,
Separately { PHONES, $8.00 } $12.50

AERIAL OUTFIT
100 feet Stranded Copper Wire
6 Composition Insulators $1.65



This wire sells anywhere for 85c and the insulators for at least $1.50. Sent to your door, ready for making your aerial, for just $1.65. Save time, labor and considerable money. Send postal or express money order. Every item guaranteed to give satisfaction.

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Contains practical suggestions on how to make your home artistic, cheery and inviting—explains how you can easily and economically refinish and keep woodwork, furniture and floors in perfect condition.

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If so, you will find this book particularly interesting and useful, for it tells how to finish inexpensive soft woods so they are as beautiful and artistic as hard wood. Tells just what materials to use—how to apply them—includes color card—gives covering capacities, etc.

Our Individual Advice Department will give a prompt and expert answer to all questions on interior wood finishing—without cost or obligation.

We will gladly send this book free and postpaid for the name and address of one of the best painters in your locality. And for 10c we will also send you postpaid a 2 oz. bottle of Johnson's Liquid Prepared Wax.

S. C. JOHNSON & SON, Dept. RN7, Racine, Wis.
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Wilmington Fibre Specialty Co., Wilmington, Del.
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RADIO FREQUENCY AMPLIFIERS
and Clapp-Eastham, Westinghouse, and Grebe Receiving Sets

Complete Receiving Outfits for Delivery

MASSEY RADIO COMPANY
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mercial, on C. W. and I. C. W., with interior Government stations, as well as with ships and nearby island stations of the various colonized islands of the West Indies, such as Curacao, Trinidad, Tobago, Barbadoes, Martinique, Guadaloupe, St. Croix, St. Thomas, Porto Rico and Haiti. The efficiency of these sets over the "spark" has proved their superiority, both in atmospheric and signal interference.

Porto Rico, however, has no commercial station which is capable of handling commercial traffic to and from the two hemispheres. At present the amateurs are planning to penetrate this field, which up to the present has never been developed. There are now about five or six licensed amateurs on the Island; this includes one Radiophone set, which has done more to boost the Radio game than the other sets, or even spark receivers.

In the Capital City, San Juan, there is an incorporated Radio Club, which is issuing a simple, concise course of Radio instruction, free of charge to its members. There is also a Radio school of instruction which has students in nearly all of the Latin-American Republics. This school is teaching exclusively in the Spanish language, and covers the latest up-to-date theory and practice on Radio telegraphy and Radiophone. A store has been established in San Juan equipped with receiver and loud-speaker, where apparatus, parts and vacuum tubes are always to be had at the same prices as at any of the Radio stores in the United States. Advertising is carried on in all of the periodicals and trade journals throughout Spanish-American territory.

Due to the customs of the people of these countries still being somewhat in keeping with those of their forefathers, business is not quite of the brisk nature evidenced in the States. These people think things over, see an apparatus work, and request results, and once convinced are well set in their ideas and values. They are seriously taking up the study and application of Radio, both commercially and as amateurs.

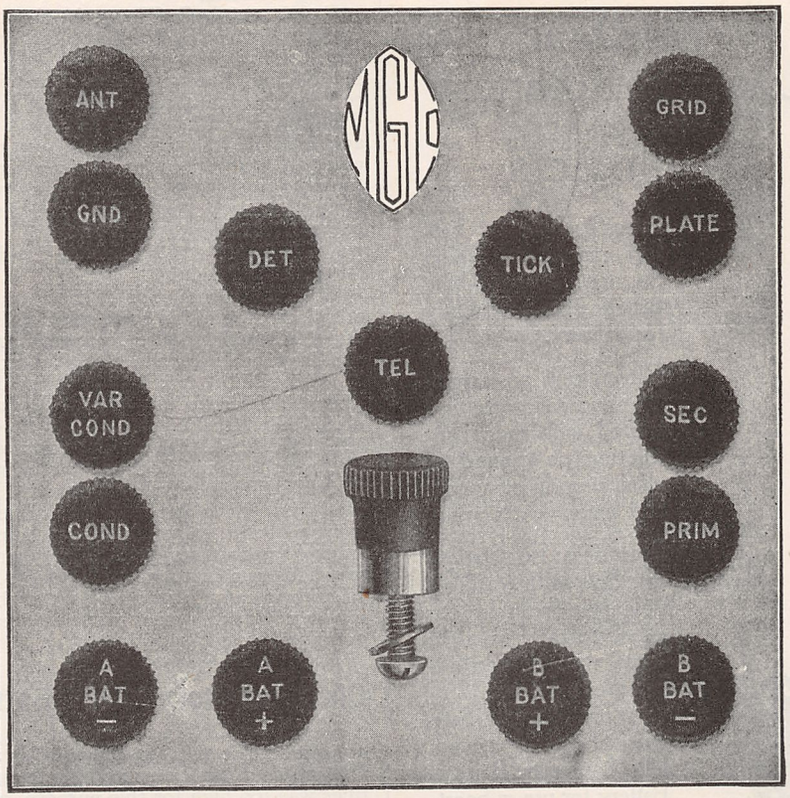
Manufacturers and dealers will readily see the field that is being opened up for them through this increase of territory, and those who advertise in the popular fiction magazines would do well to investigate this field; insertions in the Spanish language would be beneficial. There are also several Spanish periodicals which cover a very large territory.

Another interesting Radio feature is the advent of a small Radio magazine published in Spanish, giving the same class of information as contained in the popular Radio periodicals of North America. Constructional details, lists of stations, Radio laws and regulations, questions and answers on Radio, with the support of advertisers of standard Radio and electrical apparatus on the market. This is proving quite popular, not only in Porto Rico, but in all Latin-America.

There will be many people who will denounce the use of Radio in the tropics, but those who have spent one or two seasons there will realize that the tropics are not all static. There are what are called spots, the same as the once famous "dead-spots" off the Atlantic and Pacific Coasts. In these spots we experience an increase of atmospherics over the normal. Then, too, we notice that the static is much stronger on certain bands of wave-lengths. Starting in the vicinity of 200 meters, we have less than on 400 to 600. This is ideal for amateur "DX" work. In the neighborhood of 1200 to 1500 meters we note an increase, as also around 2700 meters. These strays generally die out entirely during the daylight, but are of increased force at night. This past winter we have had nights that were as clear as any night during winter in the New England States. The A. R. R. L. trans-Atlantic tests were audible throughout the West Indies, and many more than those who succeeded in getting across were heard very QSA. Not only East-Coast stations are heard, but "Fours," "Fives," and "Sixes" are being

"Read 'Em" Binding Posts

"Radio's Greatest Convenience"



17 STYLES PACKED IN CARTONS **25 OR 50 EACH STYLE**

Antenna, Ground, Condenser
Tickler, Plate, Detector
Secondary, Phones, Primary
A-Battery+, Grid, Filament
A-Battery—, B-Battery+, B-Battery—
Variable Condenser
A Positive and B Negative Battery Post

Quality

The quality built into every post is consistent with the high Marshall-Gerken standard. "Read 'Em" binding posts are a distinct aid to correct hook-up and add materially to the appearance and efficiency of any set. They are standard with discriminating users.

COMPLETE POST AND KNOB 15c EACH

Ask for "Read 'Em's" at Your Dealer's

The Marshall-Gerken Co.
Quality RADIO Products
MANUFACTURERS—DISTRIBUTORS
Toledo, Ohio, U. S. A.

19 Different Sizes

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22½ to 100 Volts Fully Guaranteed

Novo "B" Batteries

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NOVO MANUFACTURING COMPANY

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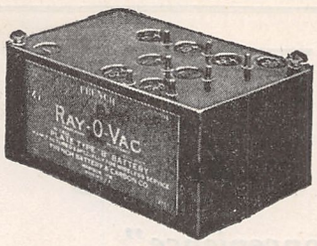
MONEY for You Add to your Salary—Make extra Pin Money. Start a lucrative business of your own.
Spend an hour each day taking subscriptions for the "Radio News." We'll pay you well and you'll enjoy the work. Write for full particulars. Circulation Dept., RADIO NEWS, 53 Park Place, N. Y. C.



Ray·O·Vac Long Life B-Battery *for all types of* Radio Sets

Specially built by battery experts for Radio Service. Ray-O-Vac batteries are now ready for delivery.

Fifteen cells are assembled as a solid unit and treated with special insulating compound to eliminate induced current and noises in receiving.

Four sizes: For Stationary Sets with variable voltages from 1½ to 22½ volts; Portable Type with voltage adjustment 18 to 22½ volts; for Airplane Sets, weight only 1 pound, full 22½ volts. Baby B Battery for use in boosting voltage when larger battery has been overworked.

Write for literature and prices.

FRENCH BATTERY & CARBON CO.
Madison Wisconsin

French RAY-O-LITES and Dry Batteries

Radio Supplies
ALL KINDS

Cunningham Tubes
A. P. Tubes
Paragon R. A. 10 Receivers
Clapp-Eastham Receivers
Baldwin Phones
Brandes Phones

ELECTRIC SUPPLY CO.
Everything in Radio
Port Arthur - - Texas

received most every night. We have an opportunity to observe fading to a marked degree; some of the Eastern stations have almost set periods of fading, others maintain steady and unusually strong signals.

KDKA, WJZ and other Radio telephone stations are being heard down here by the service of amplifier and loud-speaker. Sugar centrals are adopting the Radio telephone to some extent and the fruit growers are learning its advantages, as are the South American mining interests.

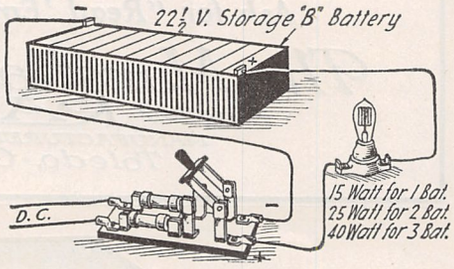
C. W. and I. C. W. are by far the most popular, being the choice of the great majority. Plans are now under way for the installation of an up-to-date transmitter and receiver in the Radio Club at San Juan. This station, with many others, will be quite active during the coming DX season, in the effort to establish and maintain a dependable route to and from South America with the United States. The slogan of "From Pekin to the Hague" will soon be modified to include, "From Pekin Via Hawaii, and Buenos Aires to the Hague."

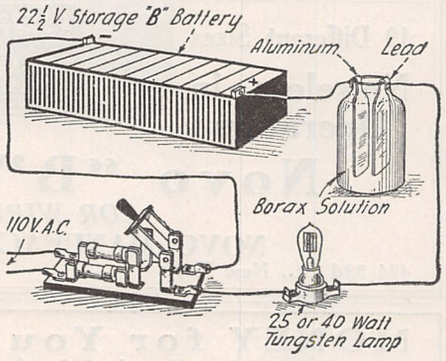
With the introduction of the Spanish periodical on Radio the popularity of Radio in Spanish-America is rapidly spreading, and it shall not be long until the Southern Hemisphere will be cooperating in maintaining that "DX" schedule that is about to be placed into effect between the United States and France. Little can be expected from Great Britain in the line of citizen Radio activities due to official suppression, but our South American brothers will come to the front with the same spirit as prompted the trans-Atlantic tests, and in another season we shall keep in touch with "ALL-AMERICA" by purely Citizen Radio, thereby opening up new fields where we never dreamed of activity.

Charging Storage "B" Batteries

As storage "B" batteries must be charged at a rate of not over two-tenths of an ampere, I found that the output of my Tungar rectifier was too high for this purpose, so I constructed a charging outfit for storage "B" batteries, which I will describe.

The rectifier consists of a pint Mason jar which is filled with a saturated solution of "20 Mule Team" borax. In the jar are placed opposite each other two strips, one aluminum and the other lead. The ends of these can be looped over the edge of the jar and binding posts attached. In series with this rectifier, a 25-watt incandescent lamp should be placed as shown in the sketch.

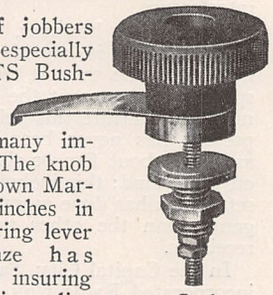




These Sketches Show How to Charge a Storage "B" Battery From an A.C. or D.C. Light Line.

RTS Equipment Specialties

RTS Switch Lever



The attention of jobbers and dealers is especially called to the RTS Bushing Lever made to retail at 60 cents. It has many improved features. The knob is of the well known Marconi type, 1¾ inches in diameter. The spring lever of nickel bronze has ground ends, insuring smooth and positive adjustment. It has a ¾-inch bushing and locknut for panel assembly. A guide bushing under the knob is an important feature as it raises the lever to the proper height for all switch points.

Announcing the New RTS Grid Condenser

The new RTS Grid Condenser is now ready for delivery. Contains many improvements not found in other types. Capacity .0005 M. F., price to retail at only.....30c each.

RTS Phone Condenser

RTS Condensers need little description. Their accuracy and simplicity have made them universally popular. The RTS phone condensers, capacity .0013 M.F., complete with binding posts ready for connection, to retail at.....35c each.

RTS Aerial Wire

A new shipment of Lake Superior solid copper No. 14 aerial wire—a bargain at.....60c per 100 ft.

RTS Rubber Binding Posts

These posts are as good as any you can find. Bushing heavily nickel plated. Give the amateurs' instruments the appearance of a first class outfit. 12c each or $1.25 a dozen.

Discounts to Dealers

Dealers and jobbers: Write us today for special quotations and discounts on all RTS equipment.

RADIO TESTING STATION
DEPT. R-7, 25 STURGIS ST.
BINGHAMTON, NEW YORK

FORMICA PANELS
3/16 Inch

6 x 7	$0.75
6 x 10½	1.00
6 x 21	2.50
6 x 14	1.75
9 x 14	2.50
12 x 14	3.00
12 x 21	5.00

The Quaker Light Supply Co.
728 ARCH STREET
PHILADELPHIA

BUY YOUR
"WOODS METAL"
AT THE "SOURCE"
RICHARDS & CO.
200 CAUSEWAY STREET
BOSTON, MASS.

The other lamp terminal should be connected to the A. C. supply and the other A. C. terminal connected to the negative terminal of the battery. The positive terminal of the battery should be connected to the aluminum plate in the rectifier.

The first time the apparatus is used the lamp will give a bright light for 10 or 15 minutes, and then it will dim; when the light burns dim the apparatus is charging correctly. A white deposit will form on the aluminum electrode; this should be left on, also the electrode will be eaten away after a time by electrolysis, but it can be replaced by another. The "B" battery should be charged every three weeks with an 8 to 24 hour charge and the borax solution should be changed frequently.

If you want to charge the battery faster, or two at a time, a 40-watt tungsten should be substituted for the 25-watt, but I do not recommend a 40-watt bulb for charging one battery.

If your home is supplied with D. C. instead of A. C., a 15-watt tungsten can be placed in series with one "B" battery as shown in the sketch, or a 25-watt for two batteries, or a 40-watt for three batteries. No other apparatus is necessary.

Contributed by
LEON G. HOWE.

Steinmetz in Talk by Radio Explodes Old Ether Theory

DR. CHARLES P. STEINMETZ, chief consulting engineer of the General Electric Company, in an address by radio from Station WGY, exploded the long-standing theory that ether in space is the transmitter of waves of sound and light.

He declared that the belief in ether must be abandoned as contradictory to Einstein's Theory of Relativity, which is now meeting general acceptance.

Sound and light, he pointed out, are borne on the wings of electric magnetic energy which spreads through space when released at the point of inception but do not form waves of motion in any body, be it proven or hypothetical.

The address of Dr. Steinmetz was broadcasted unexpectedly and without previous announcement. It was said at the General Electric Company that the speaker had addressed the American Institute of Electrical Engineers at a recent meeting on the same subject, but it was believed to be in too technical a form for radio broadcasting. The version given by him is calculated to appeal to the understanding of the lay knowledge of electricity and physics.

Dr. Steinmetz's address follows in full:

"The radio waves and the light are the same thing. The only difference is in the wave-length. The wave by which I am now speaking to you has a length of 360 meters, while the wave-length in a beam of light is only one twenty-thousandth of a centimeter, and the wave-length of the X-ray still one hundred times shorter. On the other hand, the electro-magnetic waves of our long distance transmission lines have five million meter wave-lengths.

"The only differences between radio waves and light waves are those due to the difference of wave-length. A radio wave passes through a brick wall because the thickness of the wall is only a small fraction of the wave-length, while a light wave is stopped by a thin sheet of metal, because the thickness of even the thinnest sheet of metal is many times the wave-length of a light wave.

"For a long time we have believed that light is a wave motion of some hypothetical thing, called the ether. This theory never was satisfactory because it required that the ether must be so extremely thin that the earth and all bodies move through it with terrific speeds —100,000 feet per second—without any trace of friction. And at the same time the ether must be a solid body of high rigidity. This is

BRISTOL LOUD SPEAKER

TRADE MARK

AUDIOPHONE

PATENTS PENDING DESIGN PATENT PENDING

For Radio Receiving Sets, on two or three stages of amplification. NO DISTORTION of Music and Speech. No Batteries required. A marvel of simplicity. Only one moving unit, comprising a diaphragm and an armature attached directly to it. Horn 15 inches in diameter. Handsome design, bronze finish.

PRICE, Complete - $40.00

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DON'T READ THIS

if you are a millionaire.

Complete parts for the CONSOLIDATED PATTERNS No. 1 and No. 2

Moulded bakelite tubes, 4½" diam., 5½" long	$0.90	Thordarson amplifying transformers	$4.50
Moulded bakelite tubes, 3" diam., 2⅜" long	.60	Grid leak condensers	.50
Bakelite panel, 6"x14"x⅛"	1.50	Double circuit jacks	.90
Bakelite panel, 6"x14"x3/16"	2.25	Open circuit jacks	.65
Bakelite knob and dials, 3"	1.00	Federal Universal plugs	1.75
Switch levers, 1½"	.60	Insulated knob binding posts	.10
Nickel-plated switch points, per dozen	.40	**SPECIAL THIS MONTH**	
No. 23 silk wire, per pound	1.65	7-22 stranded aerial wire, per 100 feet	.75
FADA rheostats	1.00	No. 14 solid aerial wire, per 100 feet	.50
Paragon VT Sockets	1.00	ARKAY Radio Horns, black	4.00
Chelsea 43 plate var. Condensers	4.75	ARKAY Radio Horns, nickel-plated	5.00
Coto-Coil variables	6.00	Brach lightning protectors	2.00
		Cory phones	8.00

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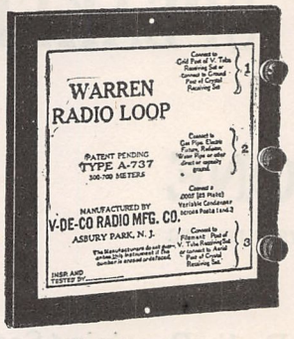
NO AERIAL



LESS STATIC

IF DAD SAYS—

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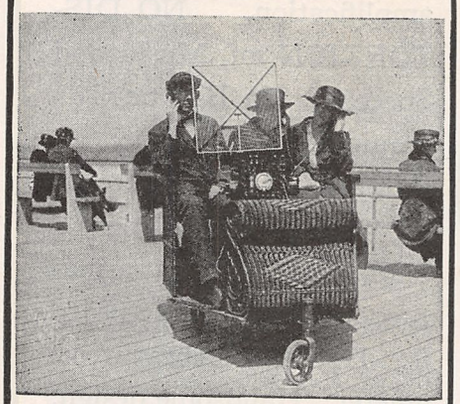

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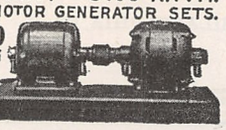

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If your jobber does not carry our products, write us direct

List of Broadcasting Stations

(*Continued from page* 72)

Owner of Station	Location of Station	Wave Lengths	Call Signal
Radio Service Co.	Charleston, W. Va.	360	WAAO
Radio Supply Co.	Los Angeles, Calif.	360	KNV
Roswell Public Service Co.	Roswell, N. Mex.	360	KNJ
Ship Owners Radio Service	Norfolk, Va.	360	WSN
Spokane Chronicle	Spokane, Wash.	360	KOE
Standard Radio Co.	Los Angeles, Calif.	360	KJC
Stix-Baer-Fuller	St. Louis, Mo.	360	WCK
St. Joseph's College	Philadelphia, Pa.	360	WPJ
St. Louis Chamber of Commerce	St. Louis, Mo.	360	WAAE
Taylor, Otto W.	Wichita, Kans.	360	WAAP
T. & H. Radio Co.	Anthony, Kans.	360	WBL
Union Stock Yards & Transit Co.	Chicago, Ill.	360, 485	WAAF
University of Missouri	Columbia, Mo.	360	WAAN

Steinmetz in Talk by Radio Explodes Old Ether Theory

(*Continued from page* 177)

unreasonable. Finally, the belief in an ether had to be abandoned as being contradicted by Einstein's Theory of Relativity, which is now meeting general acceptance.

"The mistake which led to the hypothesis of the ether was, that wave motions were the only waves known at the time when the wave theory of light was proposed, and so the light wave also was considered as a wave motion and the question asked, what moves in the light wave, and this moving thing called the ether. Since that time, we have long become familiar with waves which are not wave motions, but merely periodic phenomena. Thus the alternating current is a wave but nothing material moves in it. Thus we speak of waves of temperature, etc., without meaning any material motion.

"The radio waves and light waves are electro-magnetic waves, that is, periodic variations of the electro-magnetic field in space.

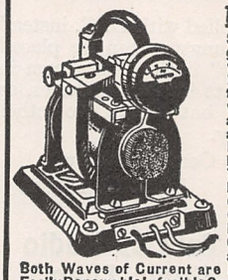
"The space in the neighborhood of a magnet is different from ordinary space. It contains magnetic energy and exerts magnetic forces on bodies susceptible to them. It is called a magnetic field. That is, it contains stored electric energy and exerts electric forces on bodies susceptible to them. An electric current produces a magnetic field. A voltage produces an electric field, and as current and voltage usually occur together, an electric circuit gives a magnetic and an electric field, that is, an electro-magnetic field.

"If voltage and current are constant, their electro-magnetic field is constant. If current and voltage vary, the electro-magnetic field varies; if they alternate, the electro-magnetic field alternates, and such an alternating electro-magnetic field we call an electro-magnetic wave. If it alternates about a million times per second, this electro-magnetic wave is a radio wave like that through which I speak to you; if it alternates nearly hundred millions of millions times per second, it is a beam of light.

"Thus the radio waves and the light ray are electro-magnetic waves, that is, alternating electro-magnetic fields. Now an electro-magnetic field is a storage of electric and magnetic energy in space, which exerts electric and magnetic forces. This energy must be supplied from the source of the wave, and this takes time, so that the electro-magnetic field or the electro-magnetic wave cannot appear instantly all through space but must gradually progress at the rate required to fill up the space with the electro-magnetic wave energy, and this gives the velocity of propagation of the electro-magnetic wave, 300 million meters per second.

"Thus the radio waves and the light rays are electro-magnetic waves, that is, alternating magnetic fields; there is no such thing as the ether, and if in the attempt to be progressive we talk about ether waves and ether telegraphy, we are just the opposite, are behind time. Thus let us stop talking about telegraphing through the ether, and rather speak of telegraphy by electro-magnetic waves."

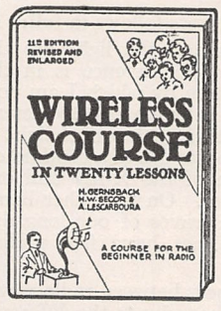
10c CHARGES RADIO & AUTO STORAGE BATTERIES AT HOME WITH AN F-F BOOSTER



So You will never have to give up in disgust when working a distant station. Is it not gratifying to feel that Your Radio Batteries will never fail and You are always ready to "Listen In" and Receive all Radiophone Broadcasting, never having to be careful of, or tell Friends Your Batteries are dead. F-F. BATTERY BOOSTERS Charge Automatically and Operate Unattended. Screw Plug in Lamp Socket. Snap Clips on Battery Terminals and see the gravity come up. Both Waves of Current are Rectified thru Adjustable & Easily Renewable Infusible Carbon Electrodes, which Maintain a Constant Efficiency & Last thousands of hours. Also Charges Batteries right in Auto. No Skill Required. AMMETER Shows Current Flowing, Eliminating Guess Work. COMPLETE IN COMPACT SELF-CONTAINED PORTABLE AUTOMATIC CHARGING UNIT. F-F Battery Boosters are Full Wave Magnetic Rectifiers for 105-125 Volt 60 Cycle A.C. Current. PRE-WAR PRICES. Bantam Type 8 Charges "A" 6 Volt Battery at 6 amperes $15
Type B Charges 2 to 100 Volt Radio "B" Batteries $15
Radio Type A-B Charges Both Your "A & B" Batteries $20
Bantam Type 12 Charges 12 Volt Battery at 5 Amperes $15
Type 166 Charges 6 Volt Battery at 12 Amperes..$24
Type 1612 Charges 12 Volt Battery at 7 Amperes..$24
Type 1626 Charges Both 6 and 12 Volt Batteries...$36
The Larger Types are for heavy Batteries, or where time is limited. Shipping Weights 11 to 15 Pounds. Order from your Dealer or Send Check for Prompt Express Shipment. If via Parcel Post have remittance include Postage & Insurance Charges. Or have us ship Type desired C. O. D. Other F-F Battery Boosters Charge Batteries from Farm Lighting Plants & D. C. Circuits. For GROUP CHARGING use our 100 Volt Automatic ROTARY Rectifier, 12 Battery, 8 ampere size: $135. Order Now or Write Immediately for FREE BOOSTER & ROTARY Bulletins 32 & 32A.

THE FRANCE MFG. CO., OFFICES & WORKS Cleveland, Ohio, U. S. A.

Canadian Rep: Battery Service & Sales Co., Hamilton, Ont.



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A New Filament Rheostat

(*Continued from page* 30)

easily be seen that the resistance depends only on the pressure applied to the column of discs and since the pressure can be regulated to any desired degree, the voltage on the filament and the corresponding current can be adjusted to the smallest fraction without any jumps and without any disturbing noises in the head set. There is no sudden change in the current or danger of "spilling the bulb." There is no point just a little too high or a little too low,—the large, easily operated adjusting knob permits of the most precise control.

The graphite discs are assembled in two small columns in the porcelain, the pressure screw acting on the discs through means of a cross-piece or equalizer. A small spring lifts this pressure equalizer from the discs when the pressure is relieved so that the circuit is opened and the "A" battery disconnected when not in use.

Since no two vacuum tubes are likely to be the same in sensibility, owing to variation in the degree of vacuum, the new instrument is intended for use with a single tube only. Synchronizing of several tubes is best accomplished with one rheostat for each filament circuit. Owing to the wide range in resistance obtained in a compression type rheostat, it can be used universally in receiving tube circuits or in 5-watt power tube circuits, without any change in connections or insertion of different resistance.

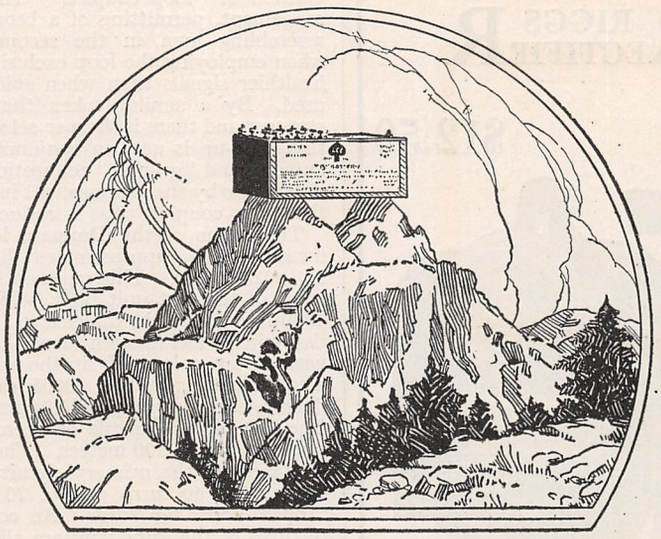
"Loop Coupler"—New Receiver

(*Continued from page* 30)

preme effort. It was an instance of capitalizing one's difficulties. Connections with the conventional antenna and ground were severed and unusually careful tuning resorted to as a means of determining the ultimate fitness of this loop as a receiver. Signals from two continuous-wave stations were "picked up."

Such is the prelude to the inception of a device which the inventor chooses to term "loop coupler." It is a tangible realization of the contemplated possibilities of a loop as an enlarged portion of the secondary coil, thus making allowance for a larger absorption of energy. Mr. Dunnam, in instantly giving concrete expression to his theory, unearthed a discarded frame, about 19 by 19 inches in dimensions, wound with three turns of small wire, and stationed it on top of the receiving cabinet. The frame, a moment before recovered from the junk heap, was connected in series with the secondary coil, a lower tap being taken off the latter to compensate for the added inductance of the loop. With the lapse of a few minutes, a dozen other radio-telephone transmitting stations came "trooping in" with their variable programs circulating through the wonders of wireless waves. The results were so convincing as to cause Mr. Dunnam to pledge future allegiance to the virtues of the loop for relay service.

Modifications in the original design of this receiving loop were made in the interest of increased efficiency. The electric circuit has been substantially improved by incorporating all of the secondary inductance in the loop and a variometer in the plate circuit for regeneration. As a convenient method of coupling the antenna and "ground" connections to the secondary circuit, when the radio-telephone receiver is not being employed with the loop alone, a six-inch revolving coil, including ten turns of wire and acting in series with a tapped loading coil is placed in the center of the loop frame. This serves in the capacity of a primary circuit,



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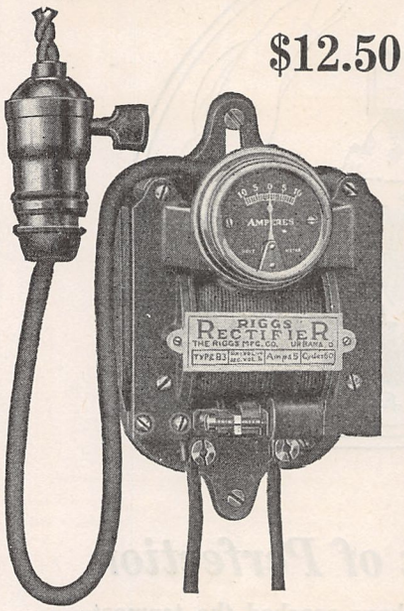

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and justifies the original title given this invention of "loop coupler." This novel arrangement, permitting of a broader energy-assembling area in the secondary circuit when employing the loop exclusively, affords healthier signals than when spider-webs are used. By a similar token the signals are stronger and there is sharper selectivity when this hook-up is used in conjunction with an antenna and "ground" connections than was obtainable by the arrangement in force before the "loop coupler" was introduced.

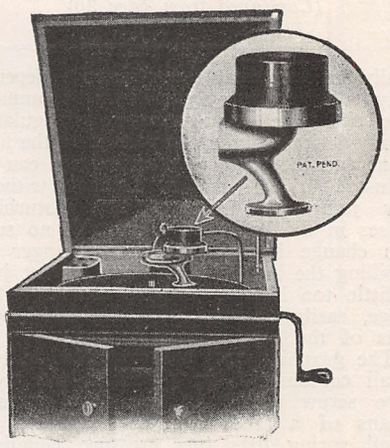
The frame of the Dunnam loop, outside measurements, approximates dimensions of 25 by 25 inches. This represents an enlargement of the first unit built, which was only 19 by 19 inches in dimensions. The secondary circuit includes ten turns of No. 20 wire, with a tap taken off at the seventh turn. The first tap, with a .0005 capacity condenser, affords a range of 175 to 400 meters. The last tap is capable of operating over a range of 250 to 500 meters. The loading inductance for the primary circuit is provided with 50 to 60 turns of No. 20 or 22 wire, tapped every ten turns. An equal number of turns of the same wire are allotted to the coupling coil. Without suggesting any arbitrary position for this loop receiver, the inventor mounted it on top of the radio-telephone cabinet. It was permitted to revolve on a pivot, the device being controlled by use of a pulley and cord-belt arrangement with a knob at the lower right-hand corner of the cabinet. This means of remote control counteracts body-capacity effects when employing the hands in proximity to the coil.

The performances of this loop, when functioning alone, have equaled the capacities of antenna and ground connections. Continuous-wave stations have been heard as far as the distance intervening between Washington and Douglas, Arizona. Intermittent communications have been negotiated with points as far removed from Washington as Neenah, Wisconsin, and with low-powered continuous-wave stations, employing one 4-watt tube and a radiation of .5 to .7 amperes, as far as Cleveland and Detroit. With the use of a Baldwin loud-speaker, signals from stations consuming a moderate degree of power can be audibly received throughout a room or even in all corners of an apartment. During evenings when atmospheric disturbances are most disconcerting to the ears, when employing antenna and ground connections, the Dunnam loop may act as an eliminator of static. The offerings of such broadcasting stations as Pittsburgh, Newark, Detroit, and Schenectady are received with distinctness and in the absence of the discordant interference of atmospheric disturbances.

To explode the theory that these pleasing results—with only the employment of two stages of audio-frequency—were derived through a coupling effect from the antenna leader, the receiver was removed into an adjoining room. Then, successively, the receiver was conveyed to the basement, sidewalk, and ultimately to a vacant lot. These respective locations exercised no unwholesome influences on the gratifying results originally obtained when the receiver was confined to a single room. When transplanted to a towering steel-framed building, however, the signals were robbed of some of their strength and the former directional effect afforded by the loop receiver under other environments was distorted.

Signals from spark stations cannot be effectively received by use of this loop, although a few signals from this source have been received with sufficient strength in their natural tones to be heard over an entire room by use of a loud-speaker. Any detector and one- or two-stage amplifier are adaptable to this strangely-formed circuit. "If the dimensions and hook-up are followed out to the letter results are guaranteed in any fair location, provided the detector and amplifiers are working properly," is the assuring statement of the inventor.

"E. S. X."



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PRICE, $3.00

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THE WHITALL ELECTRIC CO. WECO WESTERLY RHODE ISLAND

YOU WILL LIKE TRADING WITH US

IMMEDIATE DELIVERY on the Clapp-Eastham HR and HZ sets, furnished in mahogany cabinets, fine appearance, very efficient. Price, each, $40.00.

Radiotron UV-200, detectors	$5.00
Radiotron UV-201, amplifiers	6.50
Radiotron UV-202, transmitters	8.00
Westinghouse RC Sets, 180-700 meters	132.50
King Amp-li-tones, use your own receivers	12.00
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Antenna Wire, new type, 16 strands flat copper, has wonderful receiving and transmitting efficiency, greatly increases range. Per hundred feet	2.50
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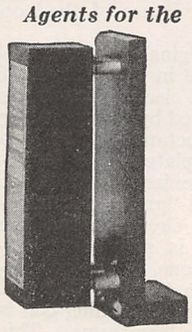

DX RADIO FREQUENCY TRANSFORMER

The secret of long distance reception. Ideal with coil aerial. Its superiority is well established. See p. 930 April-May 1922 Radio News.

Range 170- 450 meters, $8.00
" 400-1200 " 8.00
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Plug-In socket mounting 1.00

COLUMBIA RADIO SUPPLY CO.

808-19th St., N. W. **Washington, D. C.**

The directional qualities of the Dunnam progeny on continuous-wave signals, according to the inventor, are not very pronounced. This observation does not apply to spark signals inasmuch as experiments have proved that in every instance where the location of a spark transmitter is known the loop reveals its true direction irrespective of the position of the loop to the antenna. Mr. Dunnam does not attach unusual significance to his accomplishments in this particular indicating that the performance may be repeated by practically any station equipped with an effective one- or two-stage audio-frequency amplifier. Since this loop has been in service at "3ZY" station hundreds of transmitting points with their burdens of song, instrumental music and vocal speech have been heard distinctly. The major portion of these stations have been read with the use of only one-stage of audio-frequency amplification.

Daily Amateur Radio Broadcast

APRIL

The following messages were sent in plain English to amateur radio operators during the month of April at a rate of not more than twelve words per minute on 1832 meters and repeated on 175 meters.

1st—The owner of an amateur station may operate his station in accordance with the laws if his application for a license has been properly filed but has not been acted upon period

2d—Provisional station licenses are issued to amateurs remote from Headquarters of the Radio Inspector of the District in which the station is located period These licenses are issued as a matter of convenience and record period If comma the station is found to comply with the law comma the radio inspector will strike out the word provisional period

3d—Applicants for special amateur stations must state the experience and purpose of the application comma the local conditions of radio communications comma especially of maritime radio communication in the vicinity of the station comma and a special license will be granted only if some substantial benefit to the art or to commerce from individual amusement seems probable period

4th—Special amateur coast stations must be operated by a person holding a special second grade license or higher period Inland stations may be operated by persons holding amateur second grade licenses or higher period

5th—Operators holding licenses of grades other than commercial who submit satisfactory evidence showing actual operation of radio apparatus for three months during the last six months of the license term comma may be issued new licenses without examination period

6th—None

7th—The fact that Audion Tubes will not operate when the applied filament voltage drops below six volts makes the over discharging of six volt filament lead storage batteries nearly foolproof period Care must be taken however that such batteries are fully charged until specific gravity is about one and three tenths and at a rate not over ten amperes each time the charge is begun period

8th—None

9th—None

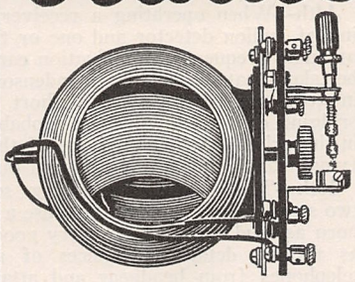
10th—PRESIDENT HARDING has proclaimed forest protection week for April sixteen to twenty second Department of Agriculture wants every troop and every scout to have a part stop Officials can get information from Washington and their State Forestry Service and local Forestry Officials stop April twenty second will be Golden Anniversary of Arbor Day established fifty years ago on initiation of Nebraska stop National Council Boy Scouts of America requests that this message be relayed and broadcasted so as to reach all

the INTRODUCING— Crystal Receiver

Order by Mail.
We Will Ship At Once!

If your dealer or jobber cannot supply you with a Crystal Receiver, write direct. List Price, $18.00. Murdock or Frost headset, $5.00. Antenna Completion Package, $5.00. Variometer, unmounted, $5.00. Send Post Office Money Order with your order.

A Radioceptor UNIT



In this—the first of Radioceptor Units—you find a receiver which combines improved electrical efficiency with beautiful mechanical appearance.

A very unusual and exclusive design of variometer forms the tuner—giving greater range of wave length than variometers heretofore designed. Only one adjustment. Continuously variable. No overlapping.

Details of finish include dark mahogany box, highly polished and engraved bakelite panels, buffed nickel parts.

The Crystal Receiver, altho complete in itself, combines with other Radioceptor Units to form a high grade long distance set.

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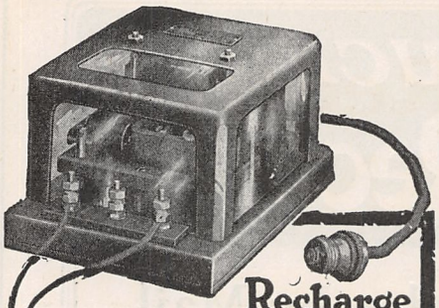

Recharge Your Battery at Home

Charges Both A and B Radio Batteries

Don't be without the use of your Radio Receiving Set while your battery is being charged. Get a Valley Charger and charge your battery right at home.

Attach the Charger to your home lamp socket—attach the clips to the battery terminals and you will get a quick, tapering charge which just exactly charges your battery, but cannot overcharge or harm it in any way.

Will charge the A 6 volt battery at a 5 ampere rate, and the B 22½ volt battery at the required ½ ampere rate. 45 volt B batteries may be connected in parallel so that they can also be charged.

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- - - - - - - - **Mail the Coupon** - - - - - - - -

Valley Electric Co., Dept. R, St. Louis, Mo.

Gentlemen: I am enclosing money order (or check) for $18.00, for which send me a Valley Battery Charger with five-panel glass display case and indicator. If not satisfactory, I will return it and get my money.

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$18.00
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SPECIAL DISCOUNT 10%

Cardboard Tubes, Seamless, Gray, ⅛-inch wall, 2½x12, 25c; 3x12, 30c; 3½x12, 35c; 4x12, 40c; 4½x12, 45c; 5x12, 50c; 5½x12, 55c; 6x12, 60c.

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6/32x13 ....15c	8/32x18 ....20c	10/32x22 ....25c

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6/32x 7 ....15c	¼x 7 ....20c	BRASS SLIDERS
6/32x 9 ....15c	¼x 9 ....20c	5/16 ....25c
6/32x13 ....20c	¼x13 ....25c	¼ 30c

MAGNET WIRE

Price per ½ lb. ¼ lb. ½ lb. ¼ lb. ½ lb. ¼ lb.

B. & S. Ga.	Enameled		Double Cotton		Double Silk	
No. 18	—	—	$.75	—	—	—
No. 20	$.60	$.30	.80	$.40	$1.00	$.50
No. 22	.65	.35	.85	.45	1.05	.55
No. 23	—	—	—	—	1.10	.60
No. 24	.70	.40	.90	.50	1.10	.60
No. 26	.75	.45	.95	.55	1.15	.65
No. 28	.80	.50	1.00	.60	1.20	.70
No. 30	.85	.55	1.05	.65	1.25	.75
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ARM TONE

Loud Speaker Phonograph Attachment for Double Receiver

Price, $3.00

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BOWDEN ARM TONE COMPANY
30 CHURCH ST., N. Y. C.

scouts throughout the whole UNITED STATES period

11th—It is hoped that scouts by communities troops and individuals will surpass last years record in observing Forest Protection Week fixed for this year by proclamation of PRESIDENT HARDING April sixteen to twenty second with April twenty second to be Golden Anniversary of Arbor Day dash tree planting in memoriam for decoration and for utility reporting trees needing attention pest fighting making signs to be placed in Parks and in woods asking public to protect trees also giving appropriate scout demonstrations during week stop Receiving stations please relay or broadcast this message to reach scouts throughout the UNITED STATES period

12th—None

13th—Following additions to list of special land stations one X A Brookline Mass One X B Greenwich Conn Three X R Hyattsville Md Five X C Birmingham Ala Five Y A Victoria Texas Five Z G Norman Okla Five Z I Birmingham Ala Five Z M Enid Okla Five Z P College Station Texas Five Z Q Ponca City Okla Six X A Alameda Cal Six X B Los Angeles Cal Six X C Oakland Cal Six Z D Phoenix Ariz Six Z F Reedley Cal Six Z I Oakland Cal Seven X G Portland Oreg Seven X H Corvallis Oreg Eight Y D East Cleveland Ohio Eight Z E Swissvale Pa Eight Z H Cincinnati Ohio Nine X A Monroe Wisc Nine Z E Fort Riley Kansas Nine Z F Sioux City Iowa period

14th—When operating a receiver consisting of audion detector and one or two steps of audio frequency amplification care should be taken that the bridging condensor is kept in good condition period A short circuited bridging condenser will most probably result in the primary winding of one of the amplifying transformers being burned out period

15th—Those having receiving sets with two steps of amplification may use a Victrola horn as loud speaker with very good results as follows detach ear pieces of receiving telephones from headgear and attach them to the T of a Victrola horn with a soft rubber bushing about one quarter inch thick one half inch inside diameter and one and one quarter outside diameter between each ear piece and ends of T stop secure ear pieces in position with heavy rubber band period

16th—None

17th—None

18th—None

19th—None

20th—Boy scouts and other amateur radio operators are requested by the United States Forest Service to receive Arbor Day Message from Secretary Wallace Department of Agriculture at Nine oclock PM Seventy-fifth meridian time April Twenty first and deliver same to the Mayors of their respective Cities stop Message will be broadcasted from principal government commercial and amateur stations by voice or code according to usual practice of station period

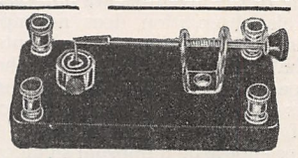
21st—Same as the 20th.

22d—To make an open core audion frequency transformer use a fibre cylinder one inch in diameter two and one half inches long on which are fitted nine fibre washers outside diameter two and three quarter inches thickness one sixteenth inch comma evenly spaced and secured to the core period. In sections one two four five seven and eight wind a secondary winding consisting of one thousand feet number forty enameled copper wire in each section stop in sections three and six wind a primary winding of fifteen hundred feet number forty enameled copper wire in each section stop all primary sections should be in series with each other stop all secondary sections should be in series with each other stop bring out primary terminals and secondary terminals to binding post as desired period

23d—A receiver composed of loose coupler tuner variable condenser and audion detector may be transformed into a regenerative receiver giving good results by inserting one

CONDENSER—DETECTOR

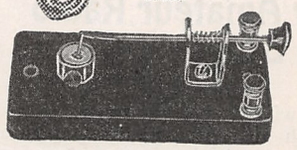
$3.00
Internally Wired, Ready for Use.



Fixed receiving condenser (001 MFD) neatly combined with a high-grade crystal detector. Phones hook on one end and tuning coil or loose coupler on the other end. Complete with Galena.

Aerial Insulators
25c B & P Moulded Connposition

Crystal Detector
Carefully made and tested in our own shop. Equipped with million point Galena. Equal to one audion tube.



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CRYSTALS
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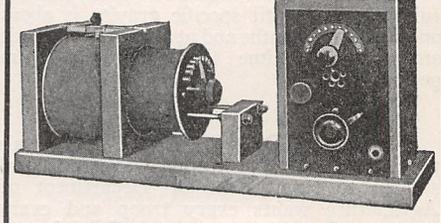
Midwest Jr. Audion Receiving Set

This outfit mounted on solid mahogany, highly finished base and consisting of our junior 600 meter wave length Coupler wound with green silk covered wire and Formica Detector Tube panel enclosed in highly polished mahogany cabinet, equipped with Rheostat, grid leak, grid condenser, potentiometer and either binding posts or jack for phones. All nickel parts highly polished.



COMPLETE OUTFIT, $22

Same as above, with crystal detector	$14.00	Crystal Detector	$1.75
Audion detector tubes	5.00	Amplifier transformer	4.00
2200-ohm head set	8.00	60 amp. ground switches	2.50
22½ volt B. batteries	2.75	Navy type, 2500 Meter loose coupler	11.00
21 plate condenser	4.25		
43 plate condenser	4.50	All sizes Formica panels.	

SIEGAL ELECTRICAL SUPPLY CO.
Main 1364-1372, 154-156 W. Washington St., Chicago.

variometer in grid circuit and another in the plate circuit period

24th—None

25th—Restricted amateur stations are those located within five miles of a Naval or Military Station stop They are restricted to a wave length not exceeding two hundred meters and to a transformer input not exceeding one half KW The operators of these stations must have an amateur second grade license or higher period

26th—The radio laws and regulations prescribe that the logarithmic decrement of all stations per complete oscillation in the wave trains permitted by the transmitter shall not exceed two tenths except when sending distress signals or signals and messages relating thereto period

27th—None

28th—None

29th—None

30th—None

RADIO DETECTIVE STORY

Wm. J. Burns, Chief of the Department of Justice Bureau of Investigation, told a story recently in which the Radio took the part of Sherlock Holmes. A dapper and bright young man appeared one day before the sales manager at a large radio manufacturing plant, and explained that he wanted to purchase a very fine receiving set for a local high school. He was greeted cordially and the best of the house's sets were demonstrated. Ordering an expensive set, he managed somehow to secure delivery without payment and then disappeared. The set also vanished from the place it had been shipped to originally, much to the consternation of the manufacturers, who decided to advertise their loss through the radio itself, being able to give a very accurate description of the young man, as he had a noticeable scar on his cheek.

Chapter two opens in an apartment where a genial and fine appearing young man, with a scar on his cheek, is entertaining his friends with his new receiving set. Suddenly the instrument begins to tell of the manufacturer's loss and give a detailed description of the thief—unmistakably the host! The consternation of the guests may be imagined. The next morning a very worried mother paid for the instrument which her son had wanted so greatly as to evolve this scheme for getting it, and the manufacturer dropped the matter.

740 RECEIVERS FOR THE LEVIATHAN

After learning of the successful test made of wireless telephone communication with the *America*, A. D. Lasker, chairman of the Shipping Board, looked over plans for reconditioning the *Leviathan* and found that 740 staterooms on the ship will be installed with wireless telephones.

THE NATIONAL RADIO CHAMBER OF COMMERCE

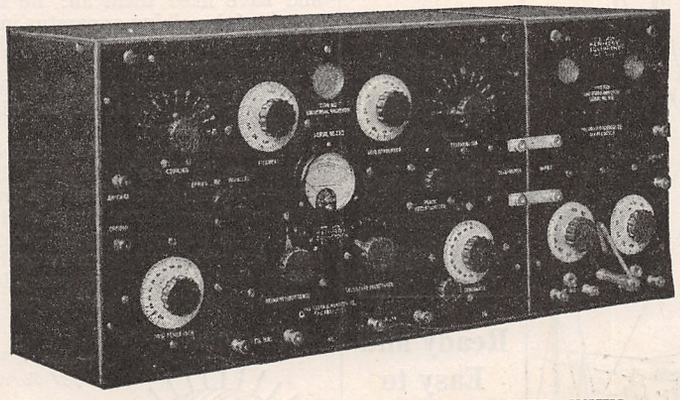
The first move to stabilize and organize the radio manufacturing industry is an accomplished fact today, following the organization of the National Radio Chamber of Commerce, and its election of officers at a dinner at the Hotel Brevoort. More than thirty leading manufacturers of radio apparatus, representing a 1922 output of $25,000,000, met and elected these officers:

President, Alexander Eisemann, of the Freed-Eisemann Radio Corporation; First Vice-President, Randall Keator, of the De Forest Telephone & Telegraph Co.; Second Vice President, William Dubilier, of the Dubilier Condenser Company; Secretary, Joseph D. R. Freed, of the Freed-Eisemann Radio Corporation; Treasurer, F. Hinners, Home Radio Corporation.

The principal address at the meeting was by E. C. Buchignani, Director of the Radio Show, held under the auspices of the Na-

Kennedy Receivers MEAN Effective Reception

Quality KENNEDY Value Wins EQUIPMENT Counts



TYPE 110 UNIVERSAL REGENERATIVE RECEIVER, WITH TYPE 525 TWO-STAGE AMPLIFIER

All Kennedy Regenerative Receivers are Licensed under Armstrong U. S. Patent No. 1,113,149

A Universal Radio Receiver, in fact, as well as in name. It can be made to detect, regenerate or oscillate at will, over its entire range of 175 to 25,000 meters. Cabinet is solid walnut, hand rubbed finish. Kennedy Quality and Workmanship are evident throughout.

Like the Universal Receiver the Type 525, two-stage amplifier is built for dependable service. It matches the receiver in height, depth and general finish.

Send for Bulletins Describing These Units

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The increasing demand for the principal Radio Magazines—"Science and Invention" and "Radio News"—has been steadily growing for many months.

The newsstands are soon stripped of their supply.

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For details and subscription blanks write

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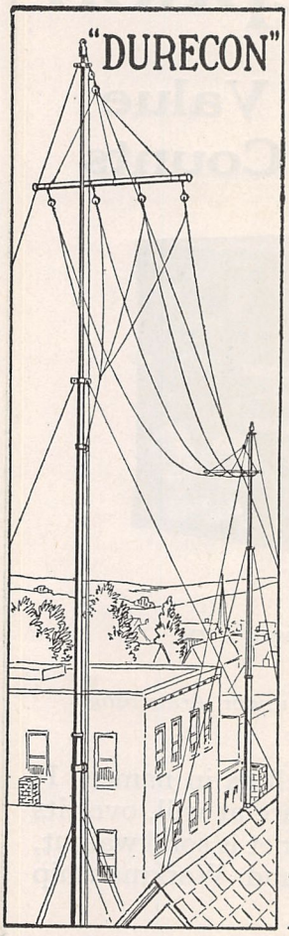

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3-plate Variable Condenser (used as a Vernier) 3.25
Above prices include knob, pointer and dial
Hard Rubber Panels for above 75
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tional Radio Chamber of Commerce, at the Seventy-first Regiment Armory. One of the first moves of the new Chamber was to vote to make this show an annual affair. Another was a code of practice to govern the industry, which has expanded so rapidly as to encompass the patronage of millions of persons in a few months.

Officers of the newly-formed chamber are enthusiastic over its accomplishments and they said today that they expect to include in its membership nearly all the manufacturers of radio equipment before their next meeting, at the show opening.

Efficient Spiderweb Coils

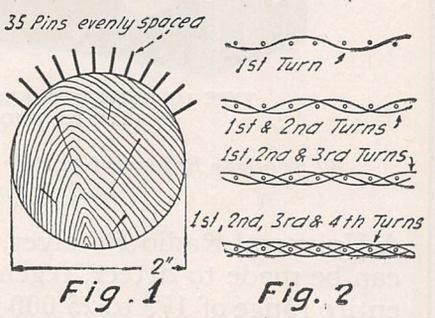
By Eric W. Bierre

November's issue of Radio News contained an article by Mr. Paul G. Watson, "Spiderweb Coils for Your Tuner."

I have read many articles by Mr. Watson and have liked them all; he has a happy knack of describing apparatus in a clear concise manner and what he has described has all been good stuff.

This time, however, with all due respect to Mr. Watson, I wish, if you will allow me, "to go one better."

I agree with him that Spiderwebs for short waves are "out on their own," but—there is a way to wind them which is a great improvement on the style now in use, and it is because I hit upon this winding by accident and because the coils have given me such remarkable results that I am sending you this description for the benefit of "bugs" in general.



This Method of Winding Pancake Coils Produces Flat Coils

Fig. 1 represents a spider made by driving 35 pins into a wooden former 2 in. in diameter and of a convenient length, and the winding is done as in the common or garden spiderweb except that, instead of winding in and out of every pin, we wind in and out of every other pin, as shown in Fig. 2. This results in a coil with its winding running in several laterals instead of being honeycombed like the ordinary spiderweb, and instead of having a corrugated surface it is quite flat.

I can guess your opinion of this "newfangled winding" after you have read this far. "No better than the old style," but let me continue.

I have been using these coils for the last two months mounted on plugs, as described by Mr. Watson, and I honestly consider them better than the most elaborate short-wave regenerative set on the market.

Situated in Wellington, I am about 500 miles from VLA (Awanui), a 40-kw. station using about 2 or 3 kw. of his power on 600 meters and he is quite readable on one tube with neither aerials nor earth connected and this is not freak work. I think you will agree that this is a pretty good test in efficiency.

With regard to size the dimensions quoted by Mr. Watson will be found to apply correctly to these coils. I wound mine of No. 24 D. S. C. wire and for a 600-meter set wound the primary and tickler with 60 turns and the secondary with 85 turns.

MUNICIPAL RADIO

The Board of Estimate is to be asked to appropriate $50,000 for the establishment of a city-owned radio broadcasting station on the top of the Municipal Building. It is

14

If your customers want data on building receiving sets, sell them

Design of Modern Radio Receiving Sets

When experimenters want information on building crystal receivers, amplifiers, regenerative sets and other equipment don't spend your valuable selling time in giving them details and diagrams—sell them MODERN RECEIVING SETS in which they will find clear photos, scale drawings, and complete information on building apparatus so simply designed that it can be made in the kitchen table workshop, yet in appearance and operation equal to the best commercial equipment.

The price is 50c
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Everett Phones - - $8.50
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Variable Condensers
21 Plate unmounted - 4.00
43 Plate unmounted - 4.50
Rheostats - - - - 1.50
Dials—3-inch - - - 1.00
Aerial Insulators - - .25

Complete Line of Parts and Accessories
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AERO MFG. CO.
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NEW ORLEANS RADIO APPARATUS and SUPPLIES
ROSE RADIO SUPPLY
604 Gravier St., New Orleans, La.
Send 10c for Latest Catalog

proposed to send from this station speeches and communications from city departments.

The scheme is intriguing, as the younger novelists say. The tired business man and his family can sit at home at the end of a hitherto imperfect day and listen to the outgivings of the best minds of the Hylan administration.

Nothing could start the program better than a five-minute talk by the Police Commissioner: "The total number of robberies today has been only 76; citizens shot or sandbagged, not fatally, 29; murders, 2; plain homicides, 5. New York is as safe tonight as it was last evening at the same hour. It is the safest city of its size in the United States. Don't forget to set your burglar alarms."

Lecture on American history by Commissioner Hirschfield: "The United States assumed no position of importance in the world until January 1, 1918, when John F. Hylan became Mayor of New York and appointed me Commissioner of Accounts. No American had an idea of his constitutional right of free speech until Mayor Hylan's underlings raided the Town Hall meeting. I am preparing a report on that subject, and it will be ready in 1956. Do not attach too much importance to the Battle of Lexington. That was a small event, lasting only one day, while the Mayor and I fight the Interests every day in the year."

Song by the Comptroller, Mr. Craig: "There's a limit on our debt, but we haven't reached it yet."

Bedtime story by Uncle John: "Once upon a time there were six million children who lived together. They incurred the hatred of some wicked goblins, known as the Special Interests, who tried to defraud them of their right to pay two or three fares morning and night. Malicious imps, disguised as the Subservient Press, deceived some of the children until the Genius of Bushwick came upon the scene and cut off the Interests' heads. This is the best governed city in the world, and anybody who doesn't admit it is a tool of the trusts, a slave of Wall Street, and the companion of terrible gamblers."

The evening could end appropriately with close harmony by the entire Board of Estimate.

—*Extract from N. Y. Herald.*

Cutting, Bending and Polishing Hard Sheet Rubber For Making Radio Apparatus

By W. S. Standiford

The experimenter and worker on all kinds of electrical apparatus usually, at some time or other, has to cut hard sheet rubber into round discs for making Wimshurst machines or for parts of wireless telegraph and telephone sets which are being used extensively. The amateur radiophone maker uses wood for his panels and cardboard tubes for his variocoupler and tuner, etc. While wood can be used for a panel, it is not nearly as effective as hard rubber, owing to electrical leakage, the amateur having enough trouble nowadays with his home-made set; the factory-made appliances are constructed of rubber or something that is equally as good.

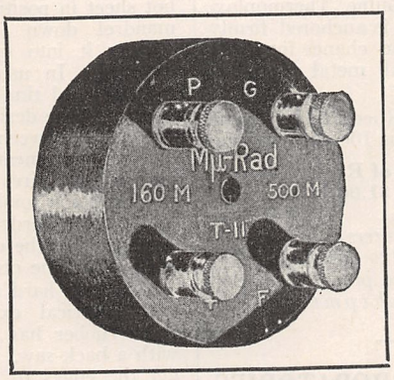
Cardboard is a fragile substance, and it does not give good service in continuous use as a variocoupler, as such material soon wears out. On account of hard rubber in its dry state being very difficult to bend into cylinders for making radio parts, the amateurs have confined themselves to wood and cardboard. A very easy way to cut and bend hard sheet rubber up to about 3/8" thick has been found by using the following method.

For a panel, either a hack-saw can be employed, or if desired, it can be shaped out wet. Mark an outline on the place to be

Mu-Rad Radio Amplification Distance Laboratories

MU-RAD

R. F. TRANSFORMERS



Manufacturers of Radio Victrola sets are standardizing on MU-RADS. Imitate those who know. Loud speakers being operated in N. Y. City from Chicago and Detroit broadcast using 3 ft. loop and two stages of MU-RAD T-11 R. F. amplification.

For the usual R. F. amplifier circuits we recommend Type T-11 transformers. Where user is more experienced and realizes the real advantages as well as the difficulties of extreme R. F. amplification, there are available also Types T-11A and T-11B for second and third stages respectively. These combinations give truly enormous sensitiveness.

For the longer wave lengths there is a new MU-RAD, Type T-12, having the same fine qualities as the T-11 series. T-12 will be available May 15th.

Type T-11....$6.00 Type T-11A....$6.50 Type T-11B....$7.50

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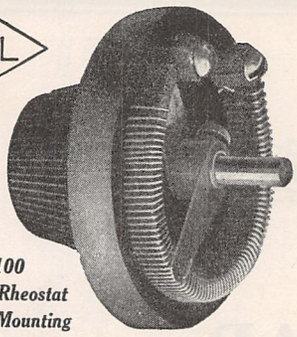

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No Magnetic Material Used in its Construction

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If you cannot obtain CRL Rheostats from your local dealer, send $1.00 plus 10c. for carriage.

List Price (East of Rocky Mountains) $1.00

Dealers and Manufacturers of Radio Equipment are invited to communicate with us. We are prepared to make immediate shipments.

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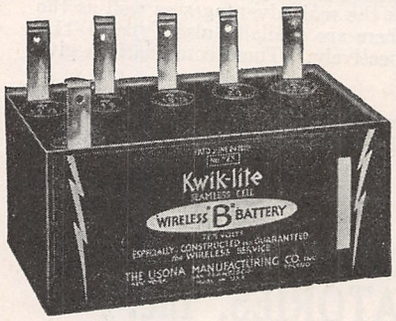

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cut with a scriber or a knife point. Then plunge the sheet into very hot water until it is soft, like leather. Take it out quickly and cut on the mark with scissors or a tinsmith's snips, depending upon the thickness of the material. As it cools, it will be harder to cut. If any more cutting is to be done, immerse it in hot water again and continue the work. Next put a plate of glass on a newspaper on your work-table, dip the rubber into hot water again, place the sheet rubber on the glass, put another sheet of glass over the rubber and weight it down. When cold, the piece will be found to be straight, as the cutting throws it out of shape.

To bend hard sheet rubber into cylinders for tuning coils, etc., make a wooden mandrel of the desired diameter, measuring its surface with a tape measure, and cut your material to the required length. Heat the rubber in hot water and place two wooden blocks on a smooth surface at such a distance apart as to be even with the edges of the rubber that requires bending. Place the hot sheet in position on blocks and press the mandrel down on its center, gradually curling it into cylindrical form to fit the mandrel. In using thick plates, reheating them several times may be necessary to get them into the desired shape. When cold, fill the crack between the two edges with automobile tire cement. There is a rubber composition for tires on the market, which is excellent for joining edges of hard rubber; this cement hardens well and is a good insulator. Tie the cylinder tightly with string until either the cement or putty has set.

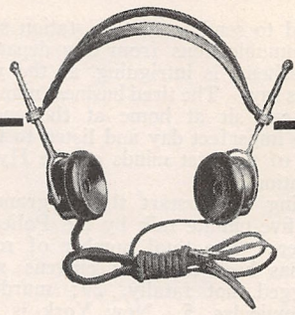
Polishing hard rubber is a poser for amateur electrical experimenters, whether the sheet rubber has been cut with scissors or with a hack-saw. They do not know how to get the edges of panels, etc., as smooth as the sides. Their usual practice is generally to smooth the edges with a file and let it go at that. This mars the appearance of the instruments. By following the process given, a fine polish can be obtained. Fasten a piece of fine grained sandpaper to the top of the work-table and run the piece of rubber across the sandpaper in a series of smooth, even strokes, taking care to keep the grain straight. Continue this operation on a second sheet of the finest sandpaper obtainable. Wipe off all dust and give the edge a coat of shellac varnish to fill the pores; when dry, rub with a piece of felt tacked upon a wooden block; this felt can be obtained at any paint store, and is known as "polishers" felt. It should be wet with oil and powdered pumice stone as an abrasive. Pumice stone can be obtained either in a drug store or a paint shop. Wipe the rubber after this operation and let it dry, then coat again with shellac. After it is dry, rub the parts with an oil-soaked piece of felt without pumice stone, and a fine polish will result. A pleasing appearance can be imparted to the smooth edges of panels and other radio apparatus by coating them with a fine grade of red enamel carefully applied, the contrast between red and black being fine.

Antenna Support Improvements

By Ben H. Woodruff

In these times of lax radio activity, construction and reconstruction at both old and new stations are being pushed. This is especially true because of the enormous increase in the number of radio receiving stations erected during the last few months, and the still larger number to be erected during the coming months. Most of these aerials have been hurriedly strung up between the house and a tree, or between two trees.

The writer has had marked success with wood poles, as antenna supports. At present there are two aerials in use at 5UE; one is a long wave receiving aerial and is 200' long



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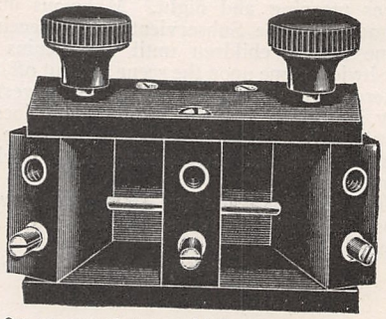

Our own manufacture and fully guaranteed. Complete with flexible leads for connection, and will not loosen up in varying the position of the coils attached.
AETACO Type A-1 Triple Coil Mounting, $5.00

Doran Bros. Receiving Set, $37.50
Pink-a-Tone Complete Set, $25.00
King Am-plitone, $12.00
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The largest and most complete stock of Radio Sets in the U.S.—all the best makes: **Radio Corp., Western Electric, Grebe, Paragon, Acme and Westinghouse. Murdock, Brandes and Federal Head Pieces.**
Cabinets, Bakelite, Dials and a complete stock of all parts for making sets.

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227-229-235 Fulton St., New York

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Unmounted 35c

The Standard Special Crystal

Treated with a new scientific process which imparts extraordinary powers of rectifying. Stays sensitive for the life of the set. Tested before and after mounting, on radiophone equipment. Every crystal of guaranteed quality.

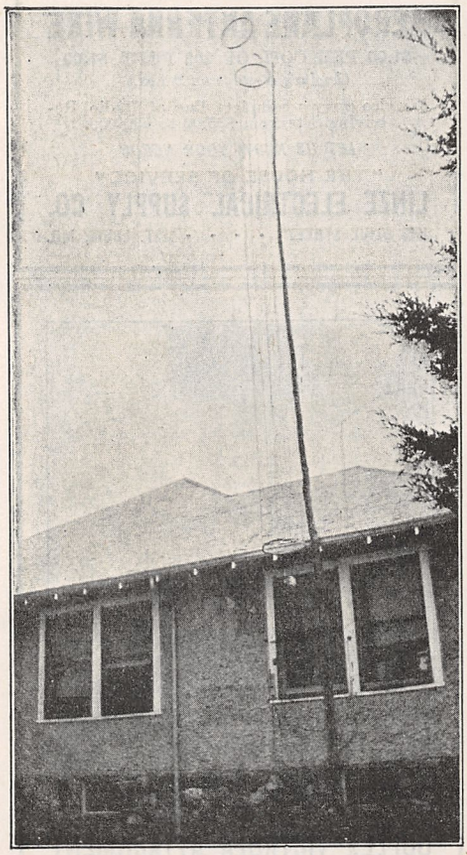
Distributors and Dealers Wanted

STANDARD CRYSTAL CO., 274 Halsey St., Newark, N. J.

and 45′ high. The short transmitting and receiving aerial is 62′ long and 50′ high.

The poles for these aerials were cut about the middle of last summer and erected soon after. As soon as the trees were felled they were barked clean and stripped of all limbs. A car was used to drag the poles to their final resting place. A word or two here concerning the trees to select might not be amiss. Trees should taper evenly from base to top. Any bulges or warts make the tree unfit for this use, also the top of the tree should not fork, to any considerable degree, for if it does the body will split very easily.

After the poles have been placed in position they should be given three coats of creosote; if there is not enough of this to cover the whole pole, about 6′ or 8′ at the bottom will aid a great deal. The guy wires and pulleys are next in order. Ordinary galvanized pulleys such as are used on awnings, etc., are not suitable. A very good type made in several sizes, has the shell and eye cast in one piece. The pulley is attached to the pole about 1′ from the top, by boring a hole in the pole and running a bolt of suitable size through. As for the means of raising



A Good Amateur Aerial Supported by a Pole Erected by the Owner.

and lowering the aerial, ordinary stranded clotheslines may be used; tarred rope also does well, but the wire seems to be better. Immediately above the pulley bolt, another bolt should be run at right angles. The ends of the upper bolt must extend for at least ½″ on either side of the pole; the guy wires are wrapped around the pole, above the top bolt, which prevents them from sliding down.

If the pole is not more than 50′ in length, three guy wires at the top will suffice. But if the poles are more than 50′ long, two sets of guy wires should be used. That is, place three more wires at about three-fourths the distance from bottom to top. Of course the guy wires are fastened so that one is on either side of the pole and at right angles to the aerial, while the third is placed parallel with the aerial, but on the opposite side of the pole.

If the aerial is to be used for transmission, the guy wires should be broken frequently at regular intervals and porcelain knobs inserted. The regular telephone knobs,

SOMERVILLE INSULATED TERMINAL

8c Another Price Reduction

The original and still the best

SOMERVILLE METAL TERMINAL

New! 15c

The slotted pillar takes cord tips or a multiplicity of wires

GOOD NEWS!

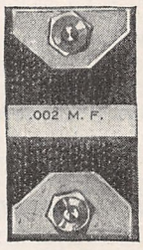
Somerville Products are again available in quantity. No more waiting

DEALERS—When This Ad Appears We Will Be Able to Supply You Satisfactorily

SOMERVILLE 22½v. "B" BATTERY

Now Ready $1.75

Has 5 positive knurled terminals, 16½v., 18v., 19½v., 21v. and 22½ volts. Made to our specifications by one of the world's foremost battery manufacturers. Twice the capacity of the small signal corps size. Should last six to nine months.



SOMERVILLE MICA CONDENSER

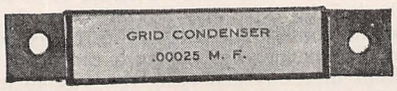
Mounted between bakelite

Power factor, 1½, 500 volt

.00025 mfd.
.0005 mfd.
.001 mfd.
.002 mfd.
) $1.00 Postpaid

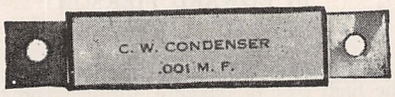
SOMERVILLE CONDENSERS

The Line Now Complete



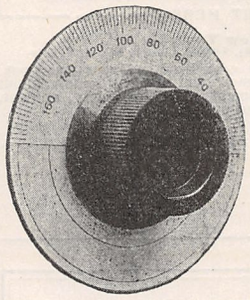
Grid Condenser, .00025 Mfd	$.25
—Above, with ½ Meg. Grid Leak	.40
Grid Condenser, .0005 Mfd	.25
—Above, with 1 Meg. Grid Leak	.40
Phone Condenser, .001 Mfd	.25
Phone Condenser, .002 Mfd	.40
Phone Condenser, .005 Mfd	.70

Quadrupled production of our famous CW Condenser enables us to make a new price schedule.



1000V. C.W. Condenser, .0005 Mfd	$.60
1000V. C.W. Condenser, .001 Mfd	.60
1000V. C.W. Condenser, .002 Mfd	.60
750V. C.W. Condenser, .005 Mfd	.80
500V. C.W. Condenser, .01 Mfd	1.00

Above ratings are for D.C. only. When used with A.C., a safety factor of 75% should be observed. Each condenser is tested at double above ratings, and any found defective should be returned for replacement.



SOMERVILLE DIAL INDICATORS

For 3/16, ¼ and 5/16 in. shafts

4 in. dia....$1.75
3¼ in. dia.. 1.60
Knob only.. .80

Postpaid from us by return mail, or from your local dealer.

This is the first metal dial with flanged knob and has the following exclusive advantages over imitations:

The knob is of real bakelite and will retain shape and finish.

The dial is of brass heavily plated with real silver and coated with a special non-peeling lacquer, which preserves the silver finish long after nickel dipped and "German" silver dials are mottled and tarnished.

The heavy brass bushings and special method of assembly, assures a dial which runs true on the shaft.

The surface finish permits writing call letters on the lower calibration space.

The dial is insulated from shaft bushing, and when grounded acts as a shield from capacity effect from body.

INSIST ON THE ORIGINAL AND BEST

SOMERVILLE RADIO LABORATORY

RETAIL SALES DIVISION

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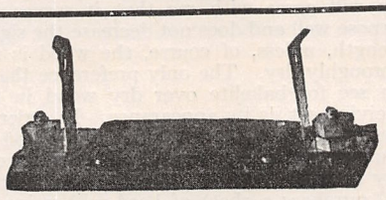
Our "OK" on Everything We Sell !



Mica Grid Condenser and Grid Leak Mountings

From .00005 to .00025 MFD	$0.50
From .0003 to .0005 MFD	.65
Mica Grid Condenser only .00005 to .00025 MFD.	.35
Mica Grid Condenser only .0003 to .0005 MFD.	.50
Grid Leak Mounting only	.25
Clips Dozen	.25

Alum. Condenser Plates (Kolster Type)

Rotor or Stator, each	.05
Spacers ⅜″ x 1/10″ thick, dozen	.08
Spacers ¾″ x 1/10″ thick, dozen	.16
Triple Coil Mounting	5.00
Plugs for mounting	.50

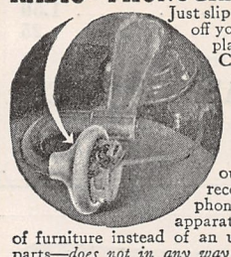
Kindly add 5c for Postage

MONTROSE MFG. CO.

1200 Bedford Avenue BKLYN., N. Y.

THE BEST LOUD SPEAKER IS YOUR *Phonograph* when used with the *"Easy"*

RADIO - PHONOGRAPH CONNECTOR



Just slip the sound box (reproducer) off your talking machine and replace it with the "Easy" Connector. Then your head phone will fit the connector perfectly. Phonograph horns are scientifically made to give the greatest possible amplification.

Your complete receiving outfit can be placed in the record compartment of your phonograph. Then your RADIO apparatus becomes a beautiful piece of furniture instead of an unsightly conglomeration of parts—*does not in any way harm the phonograph for playing records.*

No. 2 Model, now ready, fits all Victor Phonographs and Victrolas, and all other machines with tone arm same size as Victor. Sent anywhere postpaid for $1.50

DEALERS: Radio and phonograph dealers are making big money on the rapid sale of this item. Every phonograph owner is a sure buyer. The discounts are attractive. Deliveries almost immediate. Orders filled in rotation.

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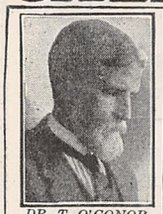
Dr. T. O'Conor Sloane Will Teach You CHEMISTRY Right In Your Own Home



DR. T. O'CONOR SLOANE, A. B., A.M., LL.D., Ph. D., Educational Director Chemical Institute of New York, Formerly Treasurer American Chemical Society and a Practical Commercial chemist as well as a noted instructor.

Good chemists command high salaries. Industrial firms of all kinds pay tempting salaries to get the right men. Salaries of $10,000 a year are not unusual for chemists of exceptional abilities. The work of the chemist is extremely interesting. If you are fond of experimenting, take up chemistry. If you want to earn more money, the way is open through our Course in Chemistry.

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Dr. Sloane will teach you Chemistry at home in a practical, intensely interesting way. Our Course is remarkably simple. No special education required—if you can read and write plain English you can thoroughly understand and master every lesson.

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The price of our course is very low and the tuition includes everything, even the chemistry outfit—there are no extras to buy with our course. You can pay in small monthly amounts as you go along. Our plan places a chemical education within the reach of everyone.

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One special feature of our course is that we give to every student, without additional charge, the chemical equipment he will need for his studies, including forty-two pieces of laboratory apparatus and eighteen different chemicals and reagents. The fitted, heavy wooden box serves as a carrying case for the equipment and as a laboratory accessory for performing experiments.

SPECIAL 30-DAY OFFER

In addition we are making a special offer for a short time only. You owe it to yourself to find out about it. Mail the Coupon to-day for free book, "Opportunities for Chemists," and full details of our special offer. Act immediately before this offer is withdrawn.

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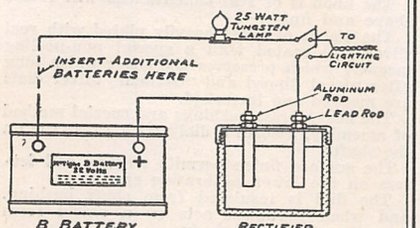
THE McTIGHE STORAGE B BATTERY



The McTighe Storage "B" Battery is of the alkaline type, is the most satisfactory source of plate potential, and can be charged from your lighting circuit for less than one cent. Can also be charged from farm lighting systems.

In ordinary service a one-hour charge will last for several weeks.

The Battery is furnished in a 24 volt unit in an attractive case.

It is noiseless and cannot be injured by accidental short circuit, overcharging or by standing idle.

Descriptive leaflet on request

PRICES

Battery	**$4.00**
Rectifier	**1.50**
Rubber Filler	**.25**

F.O.B. Irwin, Pa.

ECONOMIC APPLIANCE CO.

Successors to McTighe Battery Co.,

Water Street - - IRWIN, PA.

Wanted: Railway Mail Clerks, $135 to $195 Month

U. S. Government wants hundreds. Men—boys over 17. Write IMMEDIATELY for free list of Government positions now open.

FRANKLIN INSTITUTE. Dept. E-313. **ROCHESTER, N. Y.**

number three or larger, work well, and will not pull in when the first little gale comes along. After the holes for the poles have been dug, the erection is begun.

The simplest and best way of raising the pole is by means of a rope or wire and pulley. For a 50′ pole the hoisting pulley should be placed about 35′ high. If a good, long, stout rope is unobtainable, two No. 12 wires will do. While the poles mentioned were raised by means of only one No. 12 wire, it is far safer to use two in parallel. The wire or rope should be connected to the pole about 35′ from the bottom. A board or two placed in the hole at right angles to the butt-end of the pole will aid greatly in getting the pole to slide in. After all the wires are on and the hoisting wire is on the pulley wheel, the other end of the wire or rope is tied to a car. Then, with two people at the head of the pole using the guy wires to keep the pole from swinging to one side, the car is allowed to move slowly but steadily. Great care and precaution must be taken as a heavy 50′ pole can do some damage if it falls. When the pole assumes a vertical position, the car should be stopped. The guy wires are then fastened to the preselected places, but if the aerial is not ready to be raised, the pulley wire may be lengthened and used as a stay for that side of the pole. The base of the pole should then be tamped.

In rare instances, where there are no trees or buildings close at hand, it will be necessary to erect a "gin" pole. This is simply a short pole erected, and the pulley tied to the top.

In other cases where a house is at hand, the hoisting wire may be run across the top of the house. The pole in Fig. 1 was raised in that manner by backing a car up on the front driveway and tying the wire to it.

I would be glad to hear from anyone who has difficulty, and will try to help if I can.

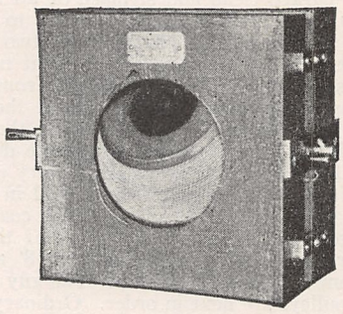
Attractive Panels and Tubing at Small Cost

By EDWARD PIERSON

Although we all desire attractive apparatus, the high cost of bakelite, formica and hard rubber panels and tubing has sometimes prevented us from possessing them. We require so much apparatus that dollars spent in purchasing unnecessary material seems like money wasted. After viewing neighboring amateur stations, it appears that the dollars have been invested in vacuum tubes, while Beaver board is being used for panels and the inductances for C. W. transmitters. After reading this article, there will be no excuse for still using such material. Beaver board may be fine for lining the inside of the box containing the rotary gap, but it was never intended to be used for panels.

If you have ever used wood for your panels you will agree with me that it serves the purpose well and does not decrease the signal strength, unless, of course, the wood is not thoroughly dry. The only preference that I can see for bakelite over dry wood in the receiving set, is its appearance. In order to secure the same appearance from wood as would be obtained from bakelite, it is necessary to go to a storage-battery repair station and purchase a sheet of hard-rubber insulation. Do not mistake thread rubber or perforated rubber for the rubber sheets. The dimensions of the sheets are 13″ long, 8″ wide, and about 16″ thick (I walked away with mine at one cent each.) It may not take more than one sheet of this rubber to cover the panel. A wooden panel of the desired size is first cut to shape. A piece of hard-rubber insulation is cut out with scissors to the same size as the wooden panel. No trouble will be encountered in cutting the hard rubber if it is first heated over a flame until it is soft. Do not put the rubber on the flame. Unless the rubber is cut while hot, it

TUNE SHARP
VARIOMETERS—VARIOCOUPLERS



VARIOMETERS Complete	$5.00
VARIOCOUPLERS "	4.00
VARIOMETERS Unassembled	4.00
VARIOCOUPLERS "	3.00

(*Include Postage on 4 Lbs.*)

KNOCKED-DOWN SET..... $10.00
Two Variometers and Variocoupler
(*Include Postage on 10 Lbs.*)

AEROPLANE ANTENNA WIRE

$1.00 PER COIL OF 200 FEET **$1.00**
(*Include Postage on 2 Lbs.*)

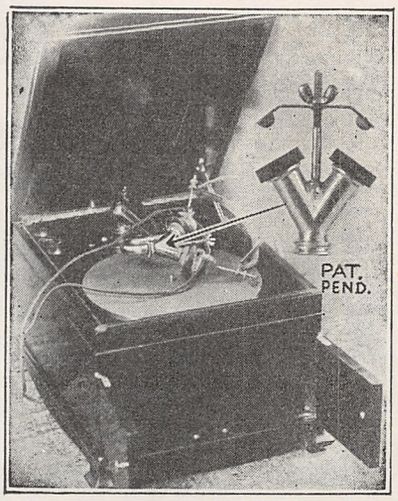
We also carry a complete line of Radio Receiving Sets from $25.00 to $300.00

LET US KNOW YOUR NEEDS

"THE HOUSE OF SERVICE"

LINZE ELECTRICAL SUPPLY CO.

1129 OLIVE STREET - - - - ST. LOUIS, MO.



DUPLEX VICTROLA ATTACHMENT
$5.00

Make a first class loud speaker of your head phones and Victrola with a DUPLEX. Highly polished aluminum and nickel plate. If your dealer does not have the DUPLEX, state make of talking machine and we will send post paid on receipt of price.

Manufactured by

W. B. McMASTERS, Wheeling, W. Va.

$4.00 **3000 Ohms**

IMMEDIATE DELIVERIES—POST PAID
Audibility Unsurpassed—Money Back if Dissatisfied
Antenna Wire—7 Strand Tinned 150 Ft., $1.60

TOWER MANUFACTURING COMPANY
6 STATION ST., BROOKLINE, MASS.

will harden and any attempt to cut it will crack it. A thick layer of good glue is spread over the wooden panel and the sheet of rubber laid on it. The rubber and wood panel are placed between blocks and left in a vise until thoroughly hardened. A coat of Velspar is applied to the wood to exclude moisture. In drilling holes always start from the rubber side first. The rubber has a nice finish and if the work is carefully done it will be hard to distinguish between it and a solid rubber panel.

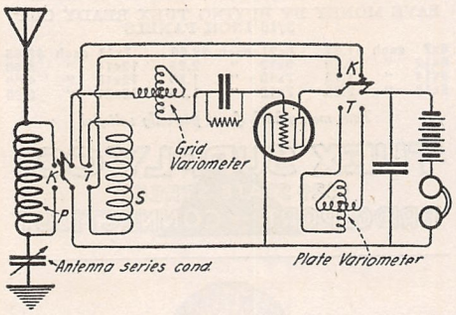
Good tubing on which to wind inductances is hard to obtain at low cost.

Conduit tubing, however, may be used in place of the ordinary types. It is easily obtained and costs very little. Conduit is used commercially to carry underground power cables and for this purpose it is necessarily moisture proof. It is a compound of tar which is not sticky and has fine turning qualities. Conduit may be procured at factories and electrical concerns. It comes in two sizes, 3½" and 4½". These sizes are just right for making variocouplers and most apparatus. It costs less than 50c. a foot, which is considerably less than most good cardboard tubing, not to mention hard rubber and formica. This conduit makes excellent tubing for C. W. inductances and when so used, the large size should be threaded in a lathe and wound with No. 14 or No. 12 gage wire; ten threads to the inch are about right for this. Threading the tube facilitates winding the wire and insulating the turns. Inductances made in this manner have stood up well on a 250-watt C. W. transmitter, and I doubt if many of the readers will ever use a set of higher voltage. Variocouplers of neat appearance may be made by turning the conduit to the right size in a lathe.

A Combination Circuit

As there has recently been considerable controversy on the subject of single circuit regenerative receivers *vs.* triple circuit sets, I am enclosing a scheme by which the latter can be arranged so as to have the advantage over the former.

If the advantages and disadvantages are summed up, it will be found that in the single



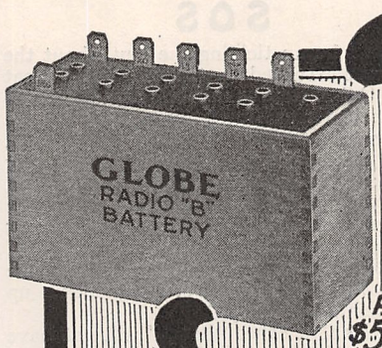
By Means of Two Switches This Receiver May Be Changed From a Single Circuit to a Three-Circuit Tuner so that a Station May Easily Be Found and Then Tuned Sharply with One and the Other Circuits.

circuit tuner selectivity is sacrificed for ease of adjustment and in the three-circuit sets, ease of tuning is sacrificed for selectivity. The last named circuit was superior until the advent of C. W. Now both tuners are very desirable, but as few can afford both, a method by which the variometer regenerative receptor could be switched to a single circuit set should meet with approval.

The method is this: By the simple addition of two D. P. D. T. switches, a three-circuit set can be thrown over to a circuit similar to the new Westinghouse Tuner, as the Grebe CR-5.

Thus the good points of both types of receivers are obtained at the cost of one plus the addition of two D. P. D. T. switches of the type described in the RADIO NEWS Accessory Prize Contest or of the Clapp-Eastham panel type.

Contributed by WM. J. O'NEILL, JR.



3¢ or less to recharge this Globe "B" Storage Battery

11 Cells, 22 Volts, 6 Terminals. Hardwood case, 3½x8¾x5¼ inches high.

This large rechargeable storage battery, with its ample capacity, and years of service, will outlast many dry batteries. It is by far the best and most active battery for radio phone service. It is more economical because it can be recharged over and over again, for less than 3c in your own home. With each "B" battery you will get full instructions for making a rectifier yourself (for charging) that will not cost over 50c.

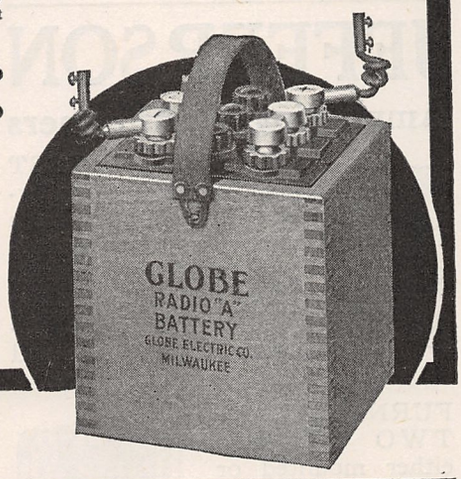
Highest Quality GLOBE ELECTRIC CO. MILWAUKEE *Fairly Priced*

Globe Radio "A" Battery

A high grade battery—long-lived and sturdy. Hardwood case, with handy carrying strap. If your dealer cannot supply you, order direct.

50 Amp. Hrs. at 3 Amp. Discharge Rate . . . $16.00

90 Amp. Hrs. at 3 Amp. Discharge Rate . . . $22.00



GLOBE ELECTRIC CO.
18 Keefe Avenue Milwaukee, Wis.

Write for Bulletin No. 20 on "A" and "B" Radio Batteries.

Liberal proposition to dealers and manufacturers

EXPERIMENTERS:

The following are the per pound prices on enameled wire delivered to you, no charge for postage or spools. If you need any other insulation write for special price list.

No. 14 ..... 51c	No. 23 ..... 71c	No. 32 ..... $1.00
No. 15 ..... 52c	No. 24 ..... 73c	No. 33 ..... 1.04
No. 16 ..... 53c	No. 25 ..... 76c	No. 34 ..... 1.08
No. 17 ..... 55c	No. 26 ..... 78c	No. 35 ..... 1.14
No. 18 ..... 62c	No. 27 ..... 81c	No. 36 ..... 1.20
No. 19 ..... 64c	No. 28 ..... 84c	No. 37 ..... 1.35
No. 20 ..... 65c	No. 29 ..... 88c	No. 38 ..... 1.55
No. 21 ..... 67c	No. 30 ..... 92c	No. 39 ..... 2.00
No. 22 ..... 69c	No. 31 ..... 96c	No. 40 ..... 2.75

Immediate delivery. No order accepted for less than one pound, or less than $1.00

AMERICAN ENAMELED MAGNET WIRE CO.
MUSKEGON, MICHIGAN

Henry J. Raphel *Radio Accessories*
Head Phones in Stock—Vario-couplers and Variometers
D. C. Battery Charger $12.50 Mail Orders Filled Promptly
303 Pearl Street, New York City

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DODGE'S INSTITUTE, D Street, Valparaiso, Ind.

A NEW BOOK FOR EXPERIMENTERS!

ELEMENTARY TEXT-BOOK ON WIRELESS VACUUM TUBES

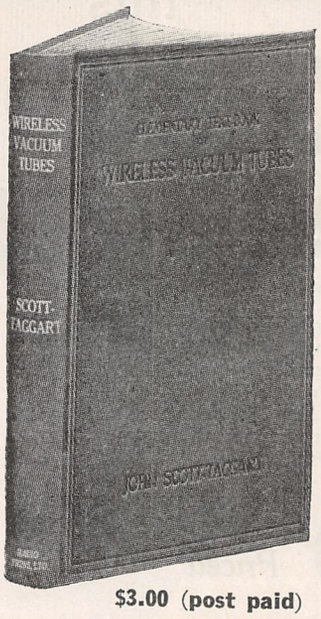
by

JOHN SCOTT-TAGGART

Member of the American Institute of Electrical Engineers

WRITTEN EXPRESSLY FOR THE AMERICAN AMATEUR

230 Pages. 130 real practical circuits. The best book on C.W. and Telephony. Handsomely bound in blue art vellum.



$3.00 (post paid)

Retailers are invited to send orders for 12 or more copies on special terms. Amateurs should ask their dealers or order direct from

RADIO PRESS, Ltd.
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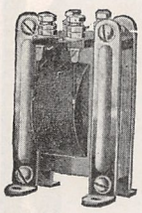
JEFFERSON

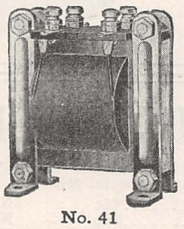
Amplifying Transformers



No. 45

BY ACTUAL TEST JEFFERSON Amplifying Transformers have proven superior to anything now on the market. Try them and note the improvement, the absence of distortion and the clearness of tone.

FURNISHED IN TWO TYPES, either mounted or unmounted. Wound with No. 40 and No. 44 wire on a core of highest grade 36 gauge Silicon steel.



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7-22 stranded copper aerial wire, 100 ft.....75

Best Grade MAGNET WIRE. Lowest prices, per ½ lb.

B. & S. Gauge	Enam.	D. C. C.	D. S. C.
No. 22	$0.44	$0.73	$1.00
No. 24	.50	.83	1.20
No. 26	.60	.93	1.40

Also other sizes. Send for free catalogue.

HUGHES ENGINEERING CO.

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SOS

When I began tickling the key, about the first question I asked my superiors was, "What does S O S mean, or rather, what words do those letters stand for?"

They accordingly fitted some words to it, such as, send out ships or save our souls; they had probably been taught that themselves, but anyway I have been going through life these past years thinking that there are words corresponding to those three letters, which I have heard used in many ways since then, the humorist having a clever story that ends up with "Same Old Story."

In order that other "hams" will not have the same mistaken idea I will tell you right here that the S O S call is a distress signal, and those three letters are used in combination because they can be sent more clearly and distinctly and will, therefore, be quickly recognized.

Contributed by EDWARD L. FRIEDMAN.

Repairing Burned Tubes

Probably most of us have at some time or another experienced the disappointment of having a vacuum tube burn out. Perhaps, when listening to a concert or a distant DX station, without warning, darkness fell behind the panel and the signals stopped abruptly. A five dollar bill faded from our vision, and to most of us, five dollars is no trifle. I have already burned out several bulbs, each of a different type, and have in all cases been able to repair them. I have also had the good luck to be able to repair a number of bulbs belonging to fellow "hams." This is how it was done. The bulb was taken from the socket and to the two filament prongs a supply of current, A. C. or D. C., preferably about three or four volts, was connected. The bulb was then taken in one hand and hit against the palm of the other rather violently so as to vibrate the broken filaments, care being taken, however, not to break the filaments completely.

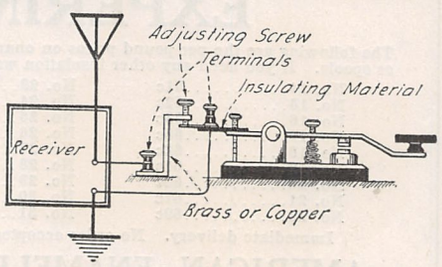
In almost every case the filaments will, if the knocks are kept up, touch at some time. Then the current already connected will light up the filaments and melt them together. This experiment, though tried a number of times on both Electron Relays and Auditrons, has yet to fail.

Contributed by
HAROLD A. ZAHLE, Porterville, Cal.

A SIMPLE BREAK-IN SYSTEM.

By HARRY C. GIVEN, JR.

WHILE endeavoring to equip my station with a break-in system by using two antennae and not being able to separate them a sufficient distance apart or in a position so that they would oppose one another, I found that the currents set up in the receiving antenna were so great as to knock the crystal out of adjustment, or if an audion was being used, to paralyze it, so I devised the scheme pictured in the enclosed diagram.



A Simple Break-in System, Which May Easily be Constructed

FOOLISH QUESTION

Question: "May I use the bed springs as an aerial?"

Answer: "We suggest that you ask your wife."

By A. J. DE LONG.

"SHRAMCO PRODUCTS"

Amateurs: Send 5c in stamps, today, for our new Catalogue L showing complete line of parts, raw materials and high grade apparatus.

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6x12	"	1.50	9x12	"	2.25	12x14	"	3.50
6x14	"	1.75	7x10	"	1.50	12x18	"	4.50
6x18	"	2.25	7x12	"	1.75	12x21	"	5.20

Your money back if not perfectly satisfied

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Reasonable in price
Highest in quality

Scientific Engineering Association

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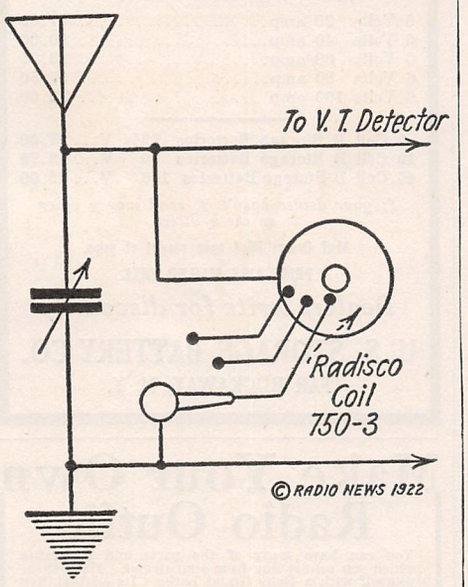
Representative—South Carolina, Georgia, Alabama and Florida

The diagram is self-explanatory; it consists of an extension arm attached to the rear end of the transmitting key, and insulated from same, bearing a contact point and binding post. The "Z" shaped arm can be made of any material, copper or brass and has at its upper end a small tapped hole into which is fitted a screw contact which makes contact with the extension arm. The contacts are adjusted so that they close just before the key contacts when the key is depressed, thus shorting the receiver, as seen in the diagram.

I do not know whether this is a new idea, but I have found that it works very well in my case, and I thought it might be of interest to others.

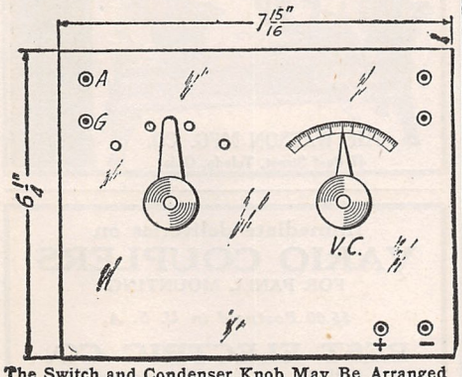
A Simple Tuner for Portable Sets

Many campers and tourists need a receiving set with which they can pick up the time signals and weather reports. The chief reason that they go without a set is because they think that it is too expensive and too heavy to carry around. The tuning part of a V. T. set or crystal set which is shown here is neither heavy nor expensive, the whole cost of the tuner being about $6.50, including the bakelite panel, which of course is expensive. This tuner, used in connection with the universal control panel described by Howard S. Pyle on page 599 of the March, 1921, issue of RADIO NEWS, makes a light and simple V. T. outfit. This set can also be used with a crystal detector without changing the connections any.

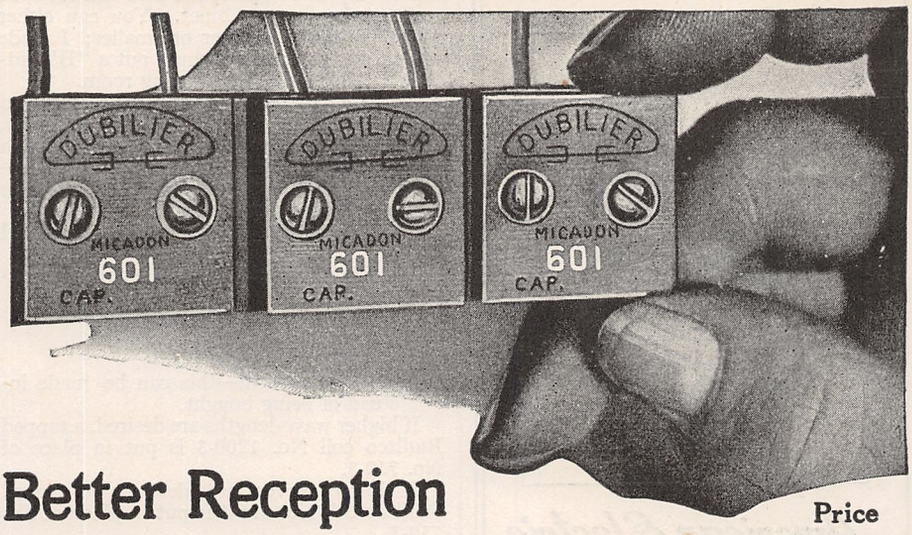


Hook-up of the Tuner Which May Be Used With a Crystal or V. T. Detector.

The cabinet I used was made out of a Yeast Foam box, 8⅝"x6¾"x4½" deep. After the box has been shellacked and varnished, it



The Switch and Condenser Knob May Be Arranged on the Panel, as Shown Here.



Better Reception With Micadons 601

Price 35c each

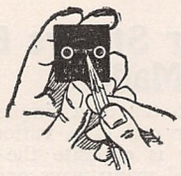
Dubilier Micadon Type 601, here shown full size, has the same perfect mica insulation, the permanent capacity that has always characterized the famous larger, Dubilier mica condenser, which is the standard equipment of 95% of the governments and radio companies of the world.

Dubilier Micadon Type 601 is a little larger than a postage stamp. Use Micadons Type 601 to build up any capacity by connecting them in series or parallel. Buy Micadons by the dozen and keep them on hand.

Dubilier Micadon Type 601 insures perfect broadcasting reception. Because the condenser layers are *pressed* together they cannot dilate and contract with the oscillations of current in the antenna. Hence the capacity cannot vary, and there can be no tube "howls" and noises due to fluctuations of capacity.

Price 35 cents each for capacities .0001 to .0005 mfd.; by the dozen $4.00. Price 40 cents each for capacities .001, .002, and .0025 mfd.; by the dozen $4.50.

Make Your Own Grid-Leak With a Lead Pencil



Sandpaper the surface of Dubilier Micadon Type 601 between the terminals. Next rub the point of a black lead pencil over the roughened surface as here shown. To adjust the grid-leak thus made rub away as much of the graphite that has been deposited as may be necessary. Every tube should have an *adjusted* grid-leak, and this is the way to make one simply and cheaply.

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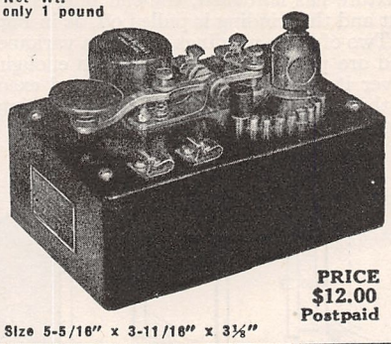

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THE THREE IN ONE SET

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(1) A practical, efficient, self-contained Wireless Receiving Set for Radio Phone Broadcasting and Commercial Stations approximately 150 to 800 meters wave length. A newly designed, dust proof, crystal detector, extremely sensitive. Can be quickly adjusted by means of buzzer test and locked in position.
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Ready for phones, aerial and ground connections. Sold on merit with our usual guarantee. Buy from your dealer or direct from us.

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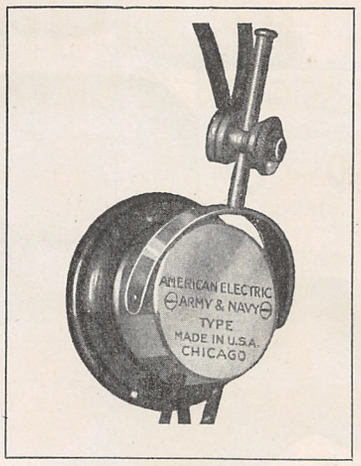

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HIGH GRADE

HEAD SETS

Army and Navy Type:

2500 OHM, PER PAIR, $10.00
3200 OHM, PER PAIR, 12.00

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2200 OHM, PER PAIR, . 8.00

American Electric
COMPANY
CHICAGO

has a very fine appearance and will serve as well as the finest cabinet. You can either make the cabinet larger or smaller; I made mine this size so that I could put a "B" battery on the inside, thus saving room.

The panel can either be of bakelite, formica, fibre or hard rubber; it is set flush in the box, resting on four supports mounted in each corner. The panel is fastened to the supports by small wood screws, or it may be fastened by some good glue.

The other parts needed besides the panel are:

1 variable condenser, 23 plate—panel mounting.
1 tapped Radisco coil No. 750-3.
4 rubber binding posts.
4 nickel-plated contact points.
1 rotary switch arm—this can be made instead of being bought.

If higher wave-lengths are desired, a tapped Radisco coil No. 1200-3 is put in place of No. 750-3.

If lower waves are desired, a tapped Radisco coil No. 325-3 is put in place of No. 750-3.

The wave-lengths are varied by means of a four-point switch, which is connected to the taps on the coil.

The variable condenser is shunted between the ground post and the wire leading from the coil; this is useful in tuning out unwanted stations.

In the upper left-hand corner of the panel, drill two holes and mount your two rubber binding posts. Mark one of them "aerial" and the other "ground." In the upper right-hand corner, directly opposite the aerial and ground posts, drill two more holes and mount two more rubber binding posts; these are to be connected later to your V. T. control.

As in Mr. Pyle's control, these two wires should be connected to the posts on the upper middle left of his panel.

Holes will also have to be drilled in the panel for the condenser rod and for the three screws that support it; also for the four switch points and for the switch arm.

Two binding posts can be fastened to the lower right of panel for connection to the "B" battery.

The hook-up and layout of panel are shown by the diagrams. Connections are made preferably with No. 14 copper wire.

Contributed by EDWIN HINES.

Variometer Stators Easily Made

I would like to tell of a simple way of making the outer coil of a variometer so that the winding is opposite the rotating ball. I have tried many ways and at last I have succeeded in making this instrument.

Fig. 1 is the moulder. It consists of half a ball cut out at one end so that a plug will fit in.

Fig. 2 shows both pieces fitted together ready for winding. This is wound with suitable wire and then covered with a mixture of sealing wax and rosin, on the wire, so that it will hold the wires together. When the mixture has hardened, the end plug is taken out and the winding is pulled off, as in Fig. 3.

Two of these windings go with a variometer and are placed in boxes just deep enough to cover it. The coil should be placed exactly in the middle of the box and the same mixture should be poured in the bottom, about ⅛"

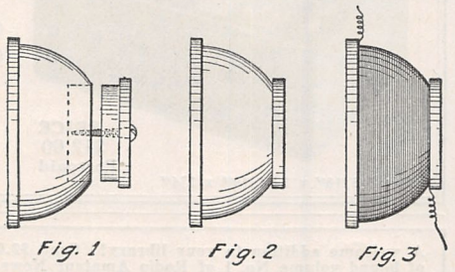

Fig. 1 Fig. 2 Fig. 3

With Such a Form, Several Fixed Windings For Variometers May Be Wound.

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SAVES YOU 50% OF COST

And you get an unconditional written 2-year guarantee. Factory to user selling methods and low operating costs make possible the remarkably low prices that we quote below, and the proven worth of the Globe Battery warrants the iron-clad guarantee that we give to every purchaser.

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The Globe NOISELESS Radio Battery was designed with the special requirements of radio operation in mind. It is not an experiment! It is made by an old established company that for years has been making the very highest type of automobile batteries. Remember that the success or failure of your set depends on the quality that you buy. The correct construction of the Globe makes them non-leak, non-conductive non-deteriorating and prevents hissing and frying noises. We back these statements with a written guarantee.

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Because of the extensive demand for a battery case that will insure home radio users against acid leakage we have designed the "Rubtex" Battery Case. It is absolutely indestructible and acid proof. $2.50 added to the prices quoted below on the Globe Batteries in wooden cases will insure you against leakage.

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Volts	Amps.	Price	Volts	Amps.	Price
6	40	$8.50	6	80	$12.50
6	60	10.00	6	100	14.50

Shipped Fully Charged Ready for Installation

Begin now to get 100 per cent. battery service at half cost by sending us your order today.

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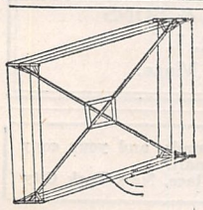

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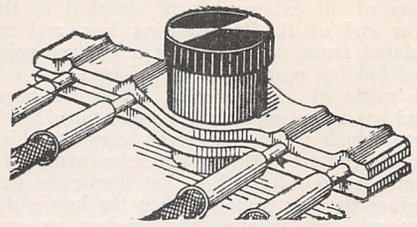

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Dual connection set provides same connection in attaching Magnavox and outfit to storage battery.

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9 Cell B Storage Batteries	22½	V...	$7.50
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VARIO COUPLERS
FOR PANEL MOUNTING

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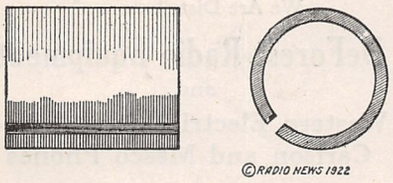
thick, or just enough to hold the coil from falling out. When two boxes are made they are placed together with the rotating ball in the middle, which is simpler to make. I have made a number now and every one has been a success and I would be very pleased if this should prove of assistance to any other amateur.

Contributed by ALBERT MARK.

FITTING A LARGE KNOB TO A SMALL SHAFT

Fitting a large-bored knob to a smaller shaft is a hard job, if there is a large discrepancy between the two. The knob usually gets on crooked, but here is a way to avoid this. Procure a hard brass tube, the outside diameter of which will fit into the knob, and the inside diameter of which will fit around the small shaft. Saw off enough to slip into the knob and slit it lengthwise with a thin saw. Insert it into the knob so that the setscrew will press upon one side of the cut, and slip it over the shaft. Screw the setscrew tight and the knob will fit perfectly.

Contributed by SHELDON TRENT.



With Such a Bushing a Dial May Be Mounted on a Small Shaft.

The Development of Radio on Airplanes in France during and Since the War

(*Continued from page* 25)

was not possible to eliminate completely. On most of the commercial airplanes the aerial consists of a wire which is unwound by the operator while in flight, and trails under the airplane.

On the airplanes travelling always over the same route as those crossing over the Channel from Paris to London, a fixed loop is used for the direction finder, some special stations being installed on the landing field, which automatically from time to time send certain signals, the intensity of which permits the pilot to rectify his route in case of deviation, caused by the wind, or fog. For the airplanes not equipped with any direction-finding system, some stations are installed on the ground, which take bearings and can at any instant tell the pilot his location.

The emergency sets are of the spark type and consist either of a spark coil supplied with storage batteries or of a more powerful set supplied with a gasoline engine driving a small alternator. For an aerial, when the airplane is on the ground or floating on the sea, a wire supported by a kite, or a small balloon, which may be blown up from a compressed gasoline tank, is used.

Another invention, which is now being applied to the airplanes, is the pilot cable, similar to those installed at the harbor entrances, permitting the ships equipped with the proper device to come safely into port without a pilot. This system consists of a cable laid at the bottom of the Channel, in which an alternating current flows. By means of a loop of wire connected to an amplifier, the pilot of the ship can follow the cable, as the sound decreases in intensity as soon as the ship is not exactly above the cable. This is being applied to the airplanes by the use of high-frequency current in a line supported by poles and erected in a known direction. The airplane in flight, by means of a loop

ARE YOU USING THE RIGHT MATERIAL FOR YOUR RADIO PARTS?

Has it high dielectric strength?
Does it withstand severe usage?
Has it a good finish?
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RADIO engineers and manufacturers have found that **C-H** Thermoplax—the **only** Thermoplax made—is the best molded insulation. It is made in both the Milwaukee and New York plants of The Cutler-Hammer Mfg. Co., and in the allied plant of the Electroplax Co. of Toronto, Canada.

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Knobs	*Honey Comb Plugs*	*Condenser Boxes*
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If it is not made by C-H, it is not THERMOPLAX

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COLD MOLDED

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Before disclosing an invention, the inventor should write for our blank form, "RECORD OF INVENTION". This should be signed and witnessed and if returned to us together with model or sketch and description of the invention we will give our opinion as to its patentable nature. Electrical cases a specialty.

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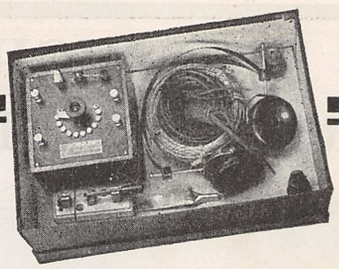

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Ready for Installation **$18**

Receiver, efficient and attractive.

Headphones, double headset, 2000 ohms.

Antenna equipment complete.

Unique in design and construction

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EVERYTHING IN RADIO

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PHILADELPHIA'S LARGEST RADIO STORE

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Manufacturers and Distributors of

RADIO APPARATUS

Complete supply of parts for Amateurs. Radio frequency loop receiving sets, portable; can be used with loud speaker.

507 Summit Avenue **Jersey City, N. J.**

Head-Sets Dials Variable Condensers

NATIONAL RADIO COMPANY

50 Union Square, New York

aerial, can follow exactly the cable, as the pilot, wearing the telephones, can judge of the intensity of the signals, which varies as soon as the airplane is no longer parallel with the cable.

Such devices are now in course of construction at several landing fields, the different lines erected north, south, east and west being supplied with current of different frequencies, so as to enable the pilot to recognize each of them by the tuning of the apparatus.

In order to make the transportation of passengers by airplane practicable and safe, various companies running planes between the large European cities are cooperating for the installation of intermediate airdromes equipped with radio stations having direction finders and telephonic communications with the nearest telegraph offices, so that messages sent by passengers during a flight can be instantly transmitted in the same way as telegrams are sent from ships to the shore. Several small observatories are also being installed along the route where observations are made frequently, which are transmitted by radio to the airplanes in the air at the time, so that they know the atmospheric conditions in the section over which they are flying.

All these improvements make travelling in airplanes safer every day and may be compared with travelling in a ship, as the passengers are given the same facilities of sending and receiving messages while in the air, which is not a little feature in long flights, such as from Prague to Paris, which lasts nine hours.

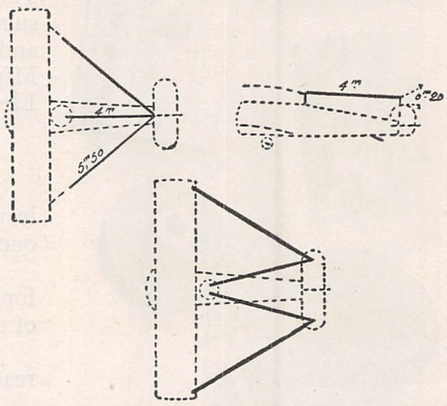

Fig. 10. Various Types of Fixed Aerial Installed on Airplanes.

Two New Radio Essentials

(*Continued from page 28*)

The Pacent "Multijack" is really three jacks built into one. This new development followed closely on the heels of the "Twin Adapter," and it may be used in connection with it. The three jacks which make up the "Multijack" are built into a composition base that may be attached to the side of a receiving cabinet or to a testing board or table. The end of the "Multijack" is flat so that a number of them can be placed end to end where a large number of connections are necessary. If three "Twin Adapters" are used in connection with a single "Multijack," as many as six connections can be made. Both the "Twin Adapter" and the "Universal Plug" fit into the "Multijack," which, like the "Twin Adapter," is provided with heavy spring contacts that are sure to form low resistance connections.

Broadcasting in Canada

Will the commercialization of the radiophone seriously threaten the existence of the daily newspaper?

Already there is under process of organization a syndicate in London, Ont., backed by several wealthy promoters and business men, which proposes to establish at Mapledene in the highlands of Middlesex county, some 14 miles north of the city of London, a high

The "QSA" Line of Radio Equipment

Larger business has made necessary larger space and larger stock. So we have moved into new quarters where we will be better able than ever to supply your wants. Items below are offered for IMMEDIATE DELIVERY.

Radiotron U.V. 200	$5.00
Radiotron U.V. 201	6.50
Radiotron U.V. 202-5 watt power tube	8.00
Federal No. 226-W amplifying transformer	7.00
Everready No. 766 variable B battery	3.00
FADA No. 120-A panel mounting rheostat	1.00
Saco Clad amplifying transformers	5.00
Paragon V.T. socket No. 30	1.00
45 Volt "B" battery, special at each	2.10
Combat Radio Storage Battery 6 v. 80 A	21.00

Catalog of "QSA" equipment will be sent for 10 cents which will be refunded on initial order or FREE with order from this advertisement.

Radiophone converts—Call, or write us for estimate on complete radio installation for receiving wireless music, etc. Come in and ask as many questions as you like.

Independent Radio Supply Co.

3239 Ogden Ave. **CHICAGO, ILL.**

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We Are Distributors of

DeForest Radio Equipment

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Western Electric, Stromberg-Carlson and Mesco Phones

Klosner Rheostats, Thordarson Transformer, Variable Condensers, Variocouplers, Variometers

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Hook Up With a WIZARD BATTERY

A special made "moisture proof" "B" battery of guaranteed long life —a veritable power house. As high in quality as it is low in price.

No.	Size	Wgt., Lbs.	Volts	Price
1623—Plain,	2x3⅜x2½	1	22½	$1.00
1623—Variable,	2x3⅜x2½	1	22½	1.20
1625—Plain,	4x6⅝x3	5	22½	1.85
1625—Variable,	4x6⅝x3	5	22½	2.25
1626—Plain,	8x6⅝x3	10	45	3.75
1626—Variable,	8x6⅝x3	10	45	4.15
1630—Variable,	3x6 x2⅜	2¾	27	1.80
1632—Variable,	5x6 x2⅜	3¾	45	2.80

At your dealer or write direct

WIZARD BATTERY CO.

173 Lafayette Street, New York City

RADIO NEWS

RADIO SUPPLIES AND EQUIPMENT

Sent Prepaid on Receipt of Price

Pink A Tone Receiving Set, mahogany cabinet, detector in glass case, Stromberg Carlson head phones.	$25.00
Atlantic, Jr., Receiving Set, complete with aerial, switch insulators, ground and 2000-ohm phones.	18.00
Mesco, 2000 ohms, complete	6.00
Mesco, 3000 ohms, complete	7.00

JACKSON SCHREIBER RADIO CO.

312 N. Euclid Ave. **St. Louis, Mo**

power broadcasting radio station, which will send out at intervals during the day and night local and world news, musical selections, lectures on philosophy, religion and education, market reports, sporting news and general newspaper and magazine items to subscribers throughout Western Ontario in whose homes will be especially constructed radio receiving sets, supplied by the radio news syndicate, and tuned and constructed to receive clearly everything sent out from the Mapledene broadcasting station.

It is believed that radio receiving sets capable of receiving the special service from the central station within a radius of 50 miles can be manufactured and supplied at a cost not exceeding very much the cost of two or three years' subscription price of a daily paper, and canvassers to be sent out to sell and install the receiving sets will endeavor to sign up the subscribers for three or four year contracts. Subscribers situated at a greater distance will pay for more powerful receiving sets.

At the breakfast hour in the mornings, a résumé of world news, farm produce quotations and possibly devotional exercises to replace individual family prayers will be sent out.

Household cooking recipes and domestic science lectures for the farmers' wives will follow during the morning, with later news at noon-time, various discussions of interest to the women in the home during the afternoon, concert programs in the early and late evening, and lullaby stories and songs for the children at bedtime.

Household drudgery will be abolished in the farm homes of Western Ontario, according to the prospectus, which the promoters of the new scheme are preparing. Dishwashing, buttermaking and bread-kneading will be done to the cheerful sound of ragtime and jazz reproduced in the farm kitchens through the radiophone.

The location of the broadcasting station in the highlands of the county north of the city where the height of land above sea level is several hundred feet more than in the city, it is claimed, together with the absence of street traffic and other jangling city noises, will increase the facility for clear transmission of the service to be supplied.

Canvassing crews of students on vacations from the universities will be sent out this summer to sell radio sets on the instalment plan.

Some Suggestions for Improving the Quality of Phone Signals

The failure to receive clear phone signals is a source of much worry to the beginner and, although he will eventually stumble onto the secret, he will never be sure he is right. Thus this little encouraging explanation.

A full-fledged amateur, rather selfish, will tell his neighbor that it is all in knowing how to tune, but it can hardly be called that, although it does somewhat approach it. The real trouble is the failure to understand, in a practical way, one of the most technical essentials of the fundamentals of radio reception, that of knowing when a set is oscillating.

Although it would be helpful, a technical discussion of this phenomenon, if it might be called that, would serve to discourage rather than encourage a future DX man. Therefore I'll give a very brief practical discussion, describing it as it will be to the beginner.

When a vacuum tube set is oscillating, it is at the stage where signals should come in. To make a set oscillate, and to determine whether it is or not, the following "program" should be followed:

Put the telephone plug in, we'll say for detector only, then fasten the "B" battery, after which turn the detector filament rheostat up until the bulb has reached its proper brilliancy, which can only be determined by actual practice, as different kinds of bulbs

ERLA

Radio Equipment

for Immediate Delivery

Every item of Erla Equipment has been designed to meet the need for highly efficient equipment at comparatively low cost. Built by experts; finest materials; most **advanced** designs. Prompt, careful attention given to mail orders.

Radio Frequency Transformer

A small, neat transformer designed to fit a V. T. Socket or be vertically mounted. Radio frequency amplification strengthens weak impulses so that they may be detected. Signals from a great distance not strong enough to be detected with audio frequency amplification can be heard perfectly with the ERLA Transformer. Price $6.00, prepaid.

V. T. Socket A sturdy, dependable socket, very easily wired or unwired and well finished. Great care has been taken to insure against leakage. The brass shell is highly nickeled on material which is chosen for its unusual dielectric strength. Price, $1.25, prepaid.

Vario Coupler The wave length is 150 to 500 meters. The ERLA operates perfectly and gives highest efficiency. Price, $4.75, prepaid.

Bezels 1½ in. diameter of highly nickeled brass. They will fit 1½ in. holes in any ⅛ to ¼ in. panel. These bezels add attractive finish to the panel of your radio cabinet. Price 25c each, prepaid.

Variable Grid Leak Pencil mark type. Resistance may be varied exactly as needed. Price 50c each, prepaid.

Grid Condenser Has mounted holes spaced to fit the lugs of our Erla Grid Leak. Type 3—.00025 M.F.D. Price 25c each, prepaid.

Jobbers: *The high quality of ERLA Equipment and our ability to make prompt shipment of large orders or small make the ERLA proposition unusually interesting. Write us.*

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Sturdy, well made and attractively finished. Guaranteed to give complete satisfaction. Ask your dealer for the "ESSEX". If he can't supply you, send us your order. Ask for catalog of ESSEX Radio Products.

ESSEX MANUFACTURING CO.
116 Mulberry Street Newark, N. J.

RADIO-FAIRY TALES

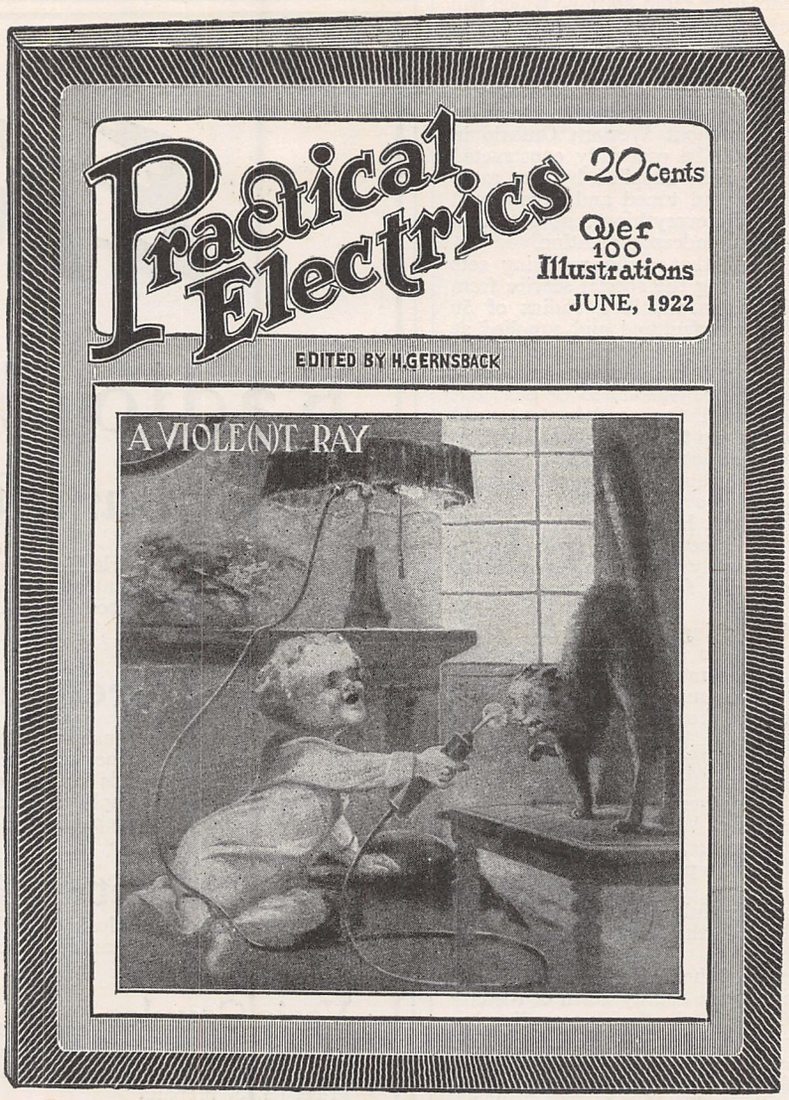
Almost everyone has concluded that it is a Fairy Tale when a dealer says **"immediate delivery."** Fairy Tales are all right for the kiddies, but others want the truth.

Here are some items for **immediate delivery:**

New Everett headsets	$8.50
Western Electric headsets	15.00
Whittal audion sockets	.75
Hesco rheostats, panel mounting	1.25
Hesco 23 plate variable condenser, panel mounting	4.00
Stelco 43 plate variable condenser, panel mounting	5.00
Magnet wire, S. C. C., 22, 24, 26, lb.	1.00

Also many other items. Send order from above list, or stamp for latest catalogue. We pay transportation anywhere in U.S.

ASHTABULA RADIO SALES CO.
Ashtabula, Ohio



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PRACTICAL ELECTRICS is probably the most novel magazine of its kind ever conceived. It is personally edited by H. Gernsback, editor of SCIENCE & INVENTION and RADIO NEWS. Mr. Gernsback, who founded the old MODERN ELECTRICS as well as the ELECTRICAL EXPERIMENTER, knows thoroughly what the public wants and has wanted for many years. In presenting this new magazine he but heeds the thousands of letters received by him to establish a new 100% electrical magazine that will beat the best that was in MODERN ELECTRICS and ELECTRICAL EXPERIMENTER.

Electricity covers such a tremendous field that the man who does not keep abreast with it does himself a great injustice. PRACTICAL ELECTRICS covers that field from every angle. It is written in plain every-day language that all can understand. It portrays the entire electrical development of the month faithfully in non-technical language. It caters to everyone interested in electricity, be he a layman, an experimenter, an electrician or an engineer—each will find in this magazine a department for himself and plenty more.

The June issue contains 48 pages and over 100 different articles and over 100 illustrations, with an artistic cover in two colors. Professor T. O'Conor Sloane, Ph.D., is associate editor of the magazine.

Leading Articles in the June Number

Laboratory Motor. Electric Hot Water Faucet. Direct Reading Ohmmeter, by A. Giolitto. Simple Testing Set, by Louis J. Albert. Electric Arc Projection Lamp Circuit, by Roy Lindberg. A Handy Switchboard for the Experimenter, by D. F. Hastings. True Electrical Stories, by H. W. Secor.

PRIZES

This magazine offers a number of prizes, as follows:
$3.00 for the best picture your electrical workshop.
$3.00 for the best article on Elec-Tricks, the new department.
$3.00 for the best "short-circuit," the semi-humorous department.
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See Current Issue for Full Details.

This issue also contains articles by some of the greatest living electrical writers, workers and students and the magazine will prove a revelation to any one interested in electricity.

Inasmuch as the new magazine has a circulation of only 27,000 copies, we urge you to place your monthly standing order with your newsdealer at once. Or if you wish, fill out the coupon below for your subscription and take advantage of our special offer.

Every issue besides its many other features contains the following departments:

"New Things Electric"
"Experimental Electrics"
"Electrical Digest"
"Junior Electrician"
"My Laboratory"
"Elec-Tricks"
"Motor Electrics"
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Make all checks payable to: "Practical Electrics Co."

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Gentlemen:
Although your regular price is $2.00 per year, you will accept my subscription at $1.75 per year (Canada and foreign $2.25). I enclose the money herewith and I have written my name and address in margin below.

R. N. 7-22

with different kinds of sets differ greatly in that respect. If, while lighting the bulb, a click is heard in the phones, stop turning and tap a binding post—the grid, we'll say. This is to make doubly sure. If a click is heard (use damp finger), and also a return click upon removal of the finger, then you may be sure that the set is oscillating. Turn the knob until some form of signal is heard. If you are listening for phone signals, you will hear what is called the carrier wave, which will peculiarly resemble a whistle. If you are reasonably close to the station which is transmitting, you will find that music will be audible in distorted form. Your duty is then to make the set stop oscillating, and to adjust it so that it is just on the point of it. Although there are other forms, the most reliable one is to turn the detector rheostat slowly down. At that point which was mentioned the signals should come in clear and loud, not distorted.

In tuning, it frequently happens that the set will jump out of oscillating, and to make reasonably sure that such has not happened (if signals are not heard) it would be advisable to make the "damp finger" test.

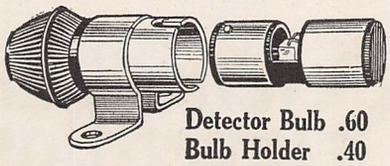
Contributed by ROY A. ANDERSON.

A Cement for Metal and Glass

In a recent issue (April-May), page 959, was published a convenient method for making a variable condenser with a couple of test tubes. Every once in a while there is an occasion like this for joining metal and glass, and, as we advance, the need for this will be greater. There are several methods advocated for this purpose, but most of them have some objection that makes it impossible for the novice to handle.

As a perfect joint is of primary importance (and a poor one too frequently a cause of trouble)—I submit a method that I have successfully used in other lines for some time.

RADIUM JEWELL DETECTOR



Detector Bulb .60
Bulb Holder .40

Requires no adjusting. Only occasional tuning, which can be done in one second.

No battery used. Can be applied to any receiving set. Takes the place of crystal detectors. No more fiddling around for sensitive spots; just pick up the phones and listen. Worth several times the price asked for this new invention. If your dealer can't supply, we will mail direct.

Dealers write for proposition

Newark Electrical Supply Distributor for New Jersey

Peerless Wireless Co., Detroit—Distributors for Michigan

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SALESMEN WANTED

Radio News and ***Science and Invention*** are the most popular and most important magazines in the Radio field.

The demand for them has never been experienced by any other publication—the News Stand sale being unprecedented—often all sold in 24 hours.

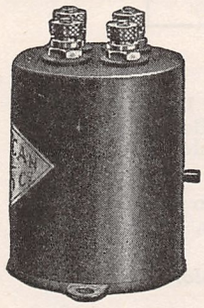
Under these conditions it is not surprising that our solicitors for subscriptions are making a wonderful record.

Our commissions are most liberal and we desire an active solicitor in every community. *For particulars write*

Mr. C. J. Wolfe, Experimenter Publishing Co.
No. 53 Park Place, New York City

THE "ALL-AMERICAN"

RADIO FREQUENCY AMPLIFYING TRANSFORMER

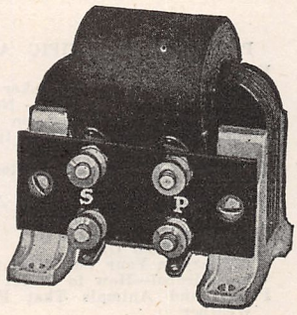


EFFICIENT ON 150---550 METERS

Designed for amateur and commercial broadcasting receiving instruments—sharp enough for the discriminating amateur and absolutely practical for the average layman who finds tuning complicated. Perfect shielding with low distributed capacity and properly impregnated to protect it from atmospheric conditions—giving pure amplification without annoying tube noises and distortion. Static disturbances are eliminated to a great extent. Can be used with Radiotron—Cunningham—Moorehead A. P. or Meyer tubes. Guaranteed to give satisfaction.

TYPE R-10 (AT YOUR DEALER) $4.50

AUDIO FREQUENCY TRANSFORMERS



TYPE R-3 Ratio 10 to 1 Mounted $4.50
TYPE R-2 Ratio 3 to 1 Mounted $4.25

THE "ALL-AMERICAN" IS THE ORIGINAL 10 TO 1 TRANSFORMER

They are manufactured strictly on a quality basis and are guaranteed to give satisfactory service. Comparison will show that they are without question the most efficient on the market. The fact that such a large number of manufacturers of AMPLIFYING units use our transformers is proof that they are superior.

We are placing on the market radio and audio frequency amplifiers to fit every receiver. Write for our bulletins describing the new "ALL-AMERICAN" radiophone receiving apparatus.

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How to build a Radio Outfit in your suit case—to take along with you on your vacation. Don't miss this tremendously important article.

Some of the Radio Articles in the June Issue

Electric Farm de Luxe. The Secret of the Telautomaton. Church Broadcasts Own Sermons. Radio for the Beginner—No. 4—Shooting Trouble in the Radio Receiver. How to Make Storage "B" Batteries. Radio-Frequency Amplification for Amateur Reception. Radio Broadcast. Radio Oracle. Question and Answer Box. A Vacation-time Radio Receiver.

SCIENCE AND INVENTION is just chock full of interesting articles and illustrations that appeal to everyone. It will hold your interest from cover to cover because it contains everything new in the field of science, invention and mechanics. Quoted by hundreds of newspapers and magazines all over the world every month.

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Partial Contents for June, 1922

POPULAR SCIENTIFIC ARTICLES

Editorial
Telephone Aids Public Speaker
Dr. Hackensaw's Secrets — No. 6 — The Secret of the Telautomaton
Frederick Winsor—First Gas Inventor
The Ray of Hercules
U. S. Has Greatest Energy Resources
New "Movie" Caricatures
Measuring Heart and Muscle Actions
Perpetual Motion at Last?
Carillons in Belgium
Building a Color Organ
A Library in Your Vest Pocket
Wood Alcohol—How to Detect It
Plants and Animals That Forecast the Weather
The Smell Organ
Demonstrating Atomic Structures
Phosphorescent Light Obtained from Violet Rays

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Name.....Town.....

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Obtain from your local druggist the following two solutions:

Solution No. 1

Silver Nitrate.....2 drams
Distilled Water.....2 ounces

Solution No. 2

Potash Hydrate.....2 drams
Distilled Water..... 2 ounces

Pour Solution No. 1 in a glass-graduate or beaker, and add gradually, little by little, Solution No. 2, stirring continually, until all the silver is thrown down. This can readily be seen by allowing the mixture to stand for a few moments, when the precipitate will quickly settle to the bottom. A few drops of the No. 2 are now added to the clear liquid above, and if no change takes place, the silver is completely thrown down.

Carefully pour off the clear liquid, which is thrown away and add fresh water. Stir thoroughly, allow to settle, and repeat several times. Now pour the precipitate on a filter in a small funnel, and wash repeatedly with water, which is thrown away as fast as it runs through the funnel. The filter should now be removed and laid aside in a warm place to dry, when it should be removed from the filter and kept for use in a bottle.

To use, take a small quantity of the powder (which is silver oxide) and rub it up in a mortar or on a glass slab or saucer with a spatula or palette knife, to the consistency of paint, with either turpentine or oil of lavender. This is now painted on the glass to be soldered and carefully heated in an alcohol flame or Bunsen flame, bringing it in contact with the flame gradually. Better still, if the lady of the house happens to be in good humor, the result can be easily accomplished by placing it in the oven, if she is baking. When cool, you will find the silver perfectly united to the glass, and wire or metal can easily be joined by means of soft solder.

Contributed by A. SCHLEIMER.

Cheap Panels for Your Set

There are undoubtedly a good many who possess radio receiving sets unmounted, who do not feel as though they want to go to the expense of purchasing a panel for the front of a cabinet for their set.

Anyone who is located where he can visit a storage battery repair shop need never want for hard rubber panels for the above purpose. The storage battery jars, when cracked, are of no use and are thrown away, and will be given to anyone asking for them.

I constructed a cabinet for my receiving set, using four panels in front, cut from old storage battery jars, and have as nice a looking cabinet as many who have purchased bakelite, formica or hard rubber in panels for this purpose.

The sides were sawed out of the old battery jars with hack saw and cut down to approximately 5" x 6½" and dressed absolutely square with a wood rasp and drilled for small round head brass screws in the positions shown on cut.

The cabinet was constructed from oak of about ⅜", but any kind of wood should do; the depth of the cabinet is left to the individual according to what equipment he has.

It will be noted that the sides, bottom and lid of the cabinet come out flush with the face of the hard rubber panels, but, of course, everyone may use his own ideas in regard to this, but in my design it takes a little more work, as there has to be small strips set in behind the rubber panels to which the panels are screwed.

In mounting honeycomb coils, or even if you want panels of greater thickness than the single hard rubber, two thicknesses can be used, battery sealing compound or shellac to glue them together.

After you have your cabinet constructed and the panels fitted in place, rub the hard rubber panels first with rough sandpaper, then with fine, and give them two thin coats of shellac.

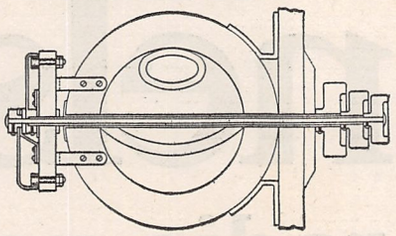
Contributed by EDGAR E. BRENTON.

"SELECTOR"

POSITIVE A RADIO SELECTIVE TUNER OR RADIO MULTIPLE CONTACT SWITCH **COMPACT**

For Cutting in Variocoupler, Loading Coil Taps, etc. Reduces the leads to a minimum.

"SELECTOR"



Can be mounted on Coupler or Coil Direct

Patent Pending

$4.25
Postpaid

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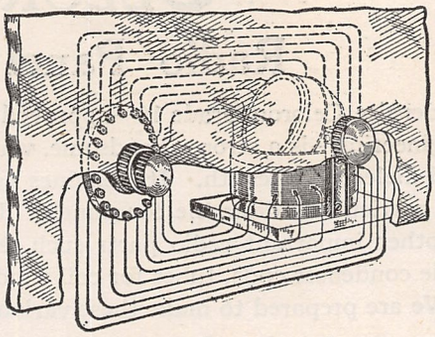
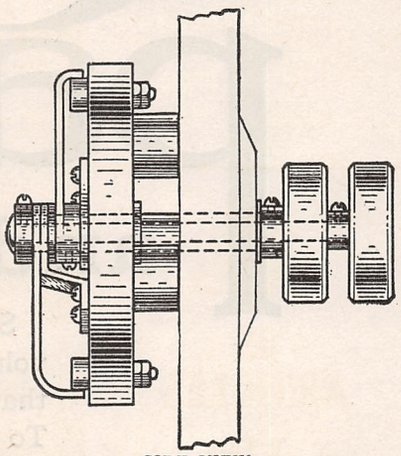


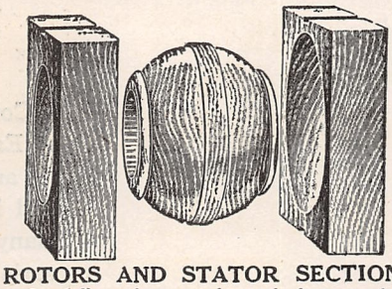
Mounted on Panel—two handles in one space—Compact also for table mounting

"SELECTOR"



SIDE VIEW

Replaces contacts on front of Panel. Saves space, labor, and is compact.



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Rotors packed 50 and 100 in package. Stator sections packed 100 and 200 in package.

Dealers! Send for interesting circular and attractive proposition. Write Dept. 36

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"B" BATTERIES
with
CHANGEABLE
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Dealers write for proposition in your territory

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Experimenter Publishing Company, Inc., 53 Park Place, New York City

Radio panels and radio parts

Start right. The panel is the very foundation of your set. High volume and surface resistance are essential factors. Make sure that you get them in both the panel and parts that you purchase. To make doubly certain look for the dealer displaying this sign.

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Radio Panel Service

Condensite Celoron Grade 10—approved by the Navy Department Bureau of Engineering—is a strong, handsome, waterproof material, high in resistivity and dielectric strength. It machines easily, engraves without feathering and is particularly desirable for panels. It is also widely used for making many other important radio parts such as tube bases, platform mountings, variable condenser ends, tubes for coil winding, bases, dials, knobs, bushings, etc. We are prepared to make these various parts to your own specifications.

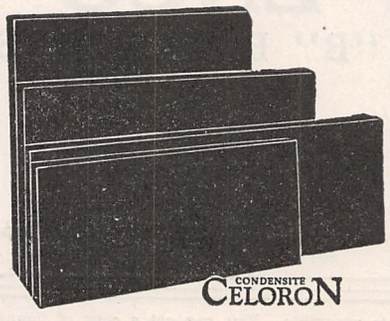
Where economy is a factor we can supply panels of Vulcanized Fibre Veneer made of hard grey fibre veneered, both sides with a waterproof, phenolic condensation product. This material has a hard, smooth, jet black surface, machines and engraves readily and will give excellent service where very high voltages at radio frequencies are not involved.

Shielded plates (patent applied for) are made with a concealed wire shield. This shield, when properly grounded, effectively neutralizes all howl and detuning effects caused by body capacities.

Send Today for Our Radio Panel Guide

Are you an enthusiast? This Guide describes our panels in detail—gives tests—and tells just how much the panel you want will cost.

Are you a Radio Dealer? Let us tell you how easily and profitably Celoron Radio Panel Service enables you to supply your customers with panels machined and engraved to their specifications. Write today for our Dealer's Proposition covering panels, dials, knobs and tubes.



DIAMOND STATE FIBRE COMPANY

BRIDGEPORT (NEAR PHILADELPHIA), PA.
BRANCH FACTORY AND WAREHOUSE, CHICAGO
OFFICES IN PRINCIPAL CITIES
IN CANADA: DIAMOND STATE FIBRE COMPANY OF CANADA, Ltd., TORONTO

New Broadcasting Licenses

WBAY—American Telephone & Telegraph Co., New York, N. Y.
WBAV—The Erner & Hopkins Co., Columbus, Ohio.
WGM—Georgia Railway & Power Co., Atlanta, Ga. (Atlanta *Constitution.*)
WBAQ—Myron L. Harmon, Y. M. C. A., South Bend, Ind.
WGI—Iowa State College, Ames, Iowa.
WBAW—Marietta College, Marietta, Ohio.
WBAU—Republican Publishing Co., Hamilton, Ohio.
KNI—T. W. Smith, Eureka, Calif.
WBAX—John H. Stenger, Jr., Wilkes-Barre, Pa.
WCX—Detroit *Free Press,* Detroit, Mich.
WCAE—Kaufmann & Baer Co., Pittsburgh, Pa.
WCAB—Newburgh News Print & Pub. Co., Newburgh, N. Y.
WBAZ—Times-Despatch Pub. Co., Richmond, Va.
KLX—Tribune Pub. Co., Oakland, Calif.
KOJ—University of Nevada, Reno, Nev.
KZV—Wenatchee Battery & Motor Co., Wenatchee, Wash.
WBAP—The *Star-Telegram,* Wortham-Carter Pub. Co., Fort Worth, Texas.
KYI—Bakersfield *Californian,* Bakersville, Calif.
WCAG—Daily States Pub. Co., New Orleans, La.
KNX—Electric Lighting Supply Co., Los Angeles, Calif.
WCAC—John Fink Jewelry Co., Fort Smith, Ark.
WCAD—St. Lawrence University, Canton, N. Y. (Only weather.)
KQI—University of California, Berkeley, Calif.
WEAK—Julius B. Abercrombie, St. Joseph, Mo.
KDZR—Bellingham Publishing Co., Bellingham, Wash.
WEAI—Cornell University, Ithaca, N. Y.
KDZI—Electric Supply Co., Wenatchee, Wash.
KDZJ—Excelsior Radio Co., Eugene, Ore.

Voices from the Air Cause Alarm

Farmers working in their fields near Lewistown, far from any buildings, were recently astonished to hear market reports coming out of the air.

Housewives had visions of burglars and ghosts when they heard voices in their attics.

It was a strange phenomenon and needed investigation, so they dropped their work and followed the voice which seemed to come from the village.

It led them to the Lewistown schoolhouse where crowds had already preceded them. The mystery was solved. From the top of the school building the voice poured forth in great volume from the Magnavox of a radio receiving set located on top of the building.

It was thought that the limit of radio service had been reached when the State Agricultural College made arrangements to place radio receiving sets in the offices of all county farm agents and then, through them, distribute market reports via radio to the farmers, but the Lewistown school has gone them one better.

The highest powered radio receiving set in Logan County was recently installed in the building at a cost of nearly $500.

The money was raised by Supt. B. A. Aughinbaugh, who made the Mingo movies famous, through his Lewistown movies, the sale of products of the manual training classes and many other school activities. The set consists of a Westinghouse R-C two-stage amplifier set; a two-stage power amplifier and the largest Magnavox obtainable.

Last month Supt. Aughinbaugh, who has been experimenting with the apparatus,

"Superior," 2,000 ohms, weight 14 ozs., complete with headband and polarity indicating cord, $8.00

Upon What Does Receiving Efficiency Depend?

WHAT is the most important instrument in your receiving outfit? The dectector? The tuning coil? The condenser? These instruments are necessary, to be sure, but of what use would they be without a pair of 'phones? This alone emphasizes their importance. They convert the weak radio currents into audible sounds. They must do it with minimum loss since receiving efficiency depends upon this.

Don't experiment with 'phones. Insist on Brandes Matched-Tone* Headsets and give your outfit more than half a chance. You do not know what it can do unless you use good 'phones—standard Brandes.

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The Best to Be Had at Any Price

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Supreme Quality Throughout. *Absoluie Satisfaction Guaranteed.*

6 Volt 80 Amp. Hr. *Special Radio, $15.75*

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Regular Automobile Battery, 9¼" x 7 5-16" x 9⅜". Same as used in Ford and many other cars. Will last several years as Radio "A" Battery

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J-M SALES COMPANY, Radio Dept., HARTFORD, CONN.

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NOW READY! **The Fourth Edition of the** **NOW READY!**

Consolidated Radio Call Book

Very Greatly Enlarged

With Seven Two-Color Radio Maps

280 pages (88 pages more than the 3rd edition), better paper, stiff covers, etc.

25,000 Copies

Some of the special information contained in the new book: All Amateur Radio Calls of the United States and Canada; Every Vessel, Coast Station, and Radio-Compass Station in the World; Radiophone Broadcasting Stations of the United States; Every High-Power Station in the World; Special Land Stations of the United States; Time Signals, Hydrographic and Weather Reports of the United States and Principal Foreign Countries; International Abbreviations; Assignment of International Calls; Press Schedules; Radiogram Rates; Cable Rates; International Morse Code and Continental Signals; and Complete General Information covering Distress Calls, International Safety Signal, Use of 800-Meter Wave Length, Amendments and Changes in Various Governmental Regulations, How to Determine Charges on Radiograms, Free Medical Advice by Radio to Vessels, and much other useful information.

The Consolidated Radio Call Book is the only book in print officially listing all the Radio calls as issued by the Bureau of Commerce. Every vessel and land station in the world is represented and listed alphabetically, according to name of vessels or land stations, and according to call letters. The New Radiophone Broadcast Section is particularly complete and gives all available information concerning Calls, Wave Lengths, Programs, etc.

Every Amateur Call in the United States and Canada Is Listed

SPECIAL RADIO MAP SECTION

Contains Five Two-Color Continental Maps showing All Stations thruout the World Handling Commercial Traffic with their Calls; a Two-Color Map showing the Amateur Radio Districts of the United States and the Principal Radiophone Broadcasting Stations with their Calls; and a Map of the United States Weather Forecast Zones.

The third edition of 10,000 copies was exhausted in two weeks. The fourth edition is selling just as quickly. Don't wait until it is all gone. Order at once, either direct from us or from your favorite dealer.

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decided to test its carrying power. He placed the Magnavox on the top of the school building and tuned up on WJJ of the Detroit *News*.

The sound began to roll out in such volume that people a mile and a quarter away declare they heard it plainly.

One man riding a plow in the fields heard market reports coming from the sky. There was no one and no buildings near and he could not imagine what caused the phenomenon.

A woman at work in her kitchen heard voices coming from what seemed to be the attic. She was too frightened to investigate. She was afraid of ghosts.

Within a short time the street in front of the school building was crowded.

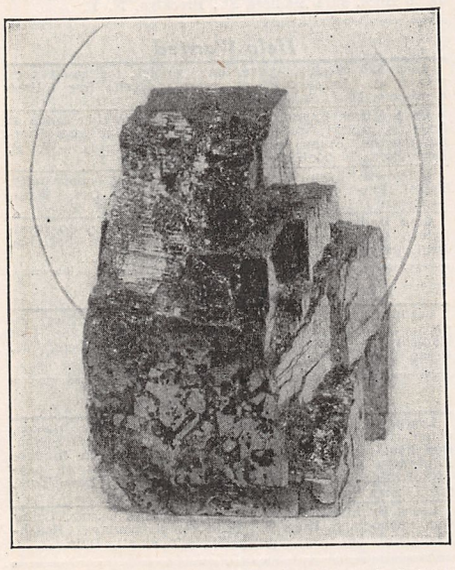
So successful was the experiment that Supt. Aughinbaugh has announced that he will give out the daily program of the broadcasting station in this manner.

Farming isn't such a bad lot after all, at least around Lewistown, for while they go on with their field work they will be entertained with news, market reports and music from Dayton, Detroit, Pittsburgh, Cincinnati, Indianapolis and many other places.

The days of miracles seem to be just beginning.

—From the Urbana, O., *Democrat*.

What Is It?



It is the Encircled Part of This Piece of Galena Which Is Shown Magnified on Page 37. Note the Peculiar Construction of This Specimen, Which Is Here Shown Full Size.

NORWAY MAY RADIO UNITED STATES

With a new and powerful radio telegraph apparatus being installed on Rundemanden, a 2,500-foot mountain at Bergen, Norway, it is believed that direct communication with America will be possible. The radio telegraph will have a 3,000 kilometer radius. An 800-kilometer radius wireless phone for communication with England and Continental Europe will also be established. The improvements represent an investment of about $25,000, and are expected to be completed in June, according to Consul George Nicolas of Bergen.

IT'S TIRED FROM SUNDAY WORK!

A radio fan who uses the clothes line as an aerial says it works well on all days except Monday.

By A. J. DE LONG.

SHIP OWNERS RADIO SERVICE INC.

80 WASHINGTON STREET, NEW YORK CITY

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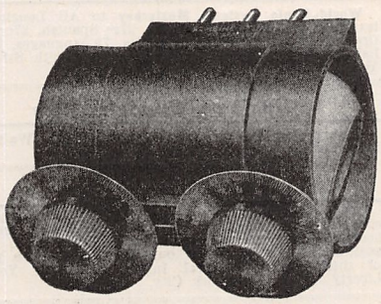
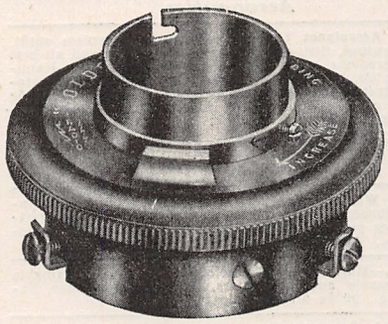


SORSINC "TUNIT"—$15.00
Patent Applied For

The "Tunit" is a balanced primary attachment for use with the standard triple coil mounting, allowing ultra-efficient reception on wave lengths from 160 to 600 meters.

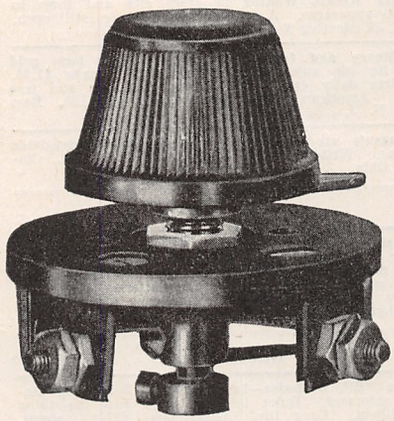


"SOCOSTAT"—$2.50

Combination Rheostat and Socket for table or panel mounting. The knurled disc will fit through a panel slot. The socostat is a space-saver.

"BRADLEYSTAT"—$1.85

A self-contained, Vernier adjustment rheostat operating on the graphite disc principle. Ideal for multi-tube control in Radio frequency circuits. Will carry up to 2½ amperes on 6 or 12 volt circuits.



"FRAMINGHAM" RHEOSTAT—$1.00

The only rheostat incorporating a panel bushing to give rigidity. The detail of construction and design makes this a highly desirable instrument. For table or panel mounting.

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Agents Wanted. Money in Radio. We teach you to install equipment. Only small capital required. Interesting agency proposition handling standard makes. Radiophone Co., Patton Bldg., Milwaukee, Wis.

Agents.—Magnetized Extractor for Eyes. Invaluable pocket sample and particulars, 50c. Gem Cinder Extractor Co., 9924a Malta, Chicago.

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Amateur Agents Wanted in every city and town to sell radio apparatus. A few stocking agencies still open. Delfelco, 12 Meeting Street, Pawtucket, R. I.

Big Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept., 133, East Orange, N. J.

Our agents are cleaning up on Phoenix Dependable Apparatus. Write Phoenix Radio and Parts Co., Cincinnati, Ohio.

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Automobile Owners, Garagemen, Mechanics, Repairmen, send for free copy of our current issue. It contains helpful, instructive information on overhauling, ignition troubles, wiring, carburetors, storage batteries, etc. Over 140 pages illustrated. Send for free copy today. Automobile Digest, 528 Butler Bldg., Cincinnati.

Batteries

Burgess "B" Batteries—Large stock. Ready for immediate shipment. Quiet in operation. Just the thing for amplifiers. Long life. Large size, 22½v. tapped. Special price, $2.75. Prepaid. Order now. The Practical Supply Co., Binghamton, N. Y.

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How to Make Wireless Receiving Apparatus. 100 pages—90 illustrations. Only strictly modern radio apparatus are described in this book and the illustrations and descriptions are so clear and simple that no trouble will be experienced in making the instruments. Paper covered, 35c postpaid. Experimenter Publishing Co., Book Dept., 53 Park Place, New York City.

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Electricians' Examinations: Book of questions and answers with diagrams, symbols, tables, notes and formulas for preparation for license. $1.25 by mail. Aaron Shapiro, 132 West 24th St., New York.

Vibrations—Sounds—Lights—and Colors. Illustrated. Stevens Publishing Company, San Francisco, California.

"Schemer Magazine," Alliance, Ohio, prints big profit schemes; one subscriber making $25,000 from three; another $10,000 from one. Try your luck. Year, only $1; three months, 25c.

We Buy and Sell back issues of Radio Amateur News and Electrical Experimenter. Boston Magazine Exchange, 109 Mountfort St., Boston, Mass.

Experimental Electricity Course in 20 Lessons. By S. Gernsback and H. W Secor, E. E. A. course of the theory and practice of Electricity for the Experimenter. Every phase of experimental electricity is treated comprehensively in plain English. New experiments are described and explained and nearly every application of Electricity in modern life is given. 160 pages—400 illustrations. Flexible cloth cover, 75c. postpaid. Stiff cloth cover, $1.25 postpaid Experimenter Publishing Co., Book Dept., 53 Park Place, New York City.

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World-Ronic System, Masterkey to All Languages, six textbooks, $1.73. French Chart, 37c; Spanish, 37c; Speech-Organs, 37c. Pronunciation-tables, 79 languages, 30c each. Languages Publishing Company, 8 West 40th Street, New York.

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Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our full page ad on page 77 of this issue. Chemical Institute of New York, 140 Liberty Street, New York City.

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Correspondence Courses at less than half original prices. Any school; any subject for men or women. Bulletin 1074 free. Courses bought. Instruction Correspondence Exchange, 1966 Broadway, New York.

Dollars Saved—Used correspondence courses of all kinds sold, rented and exchanged. List free. (Courses bought.) Lee Mountain, Pisgah, Alabama.

Send ten cents for our new large 32 page catalog describing our course entitled "How to Learn Radio at Home." National Radio Institute, Dept. 1330, 1345 Penn. Ave., N. W., Washington, D. C.

Exchange

Amateur Agents wanted in every city and town to sell radio apparatus. A few stocking agencies still open. Delfelco, 12 Meeting Street, Pawtucket, R. I.

Variocouplers: Strong, neat and guaranteed in every respect, $2.75. Postpaid. Hoboken Radio Shop, 404 Washington St., Hoboken, N. J.

Wanted for Spot Cash. High grade Radio outfits, parts, attachments and materials of standard makes. No home-made apparatus will interest us. Address Box 28, care of Radio News.

Sell—Complete transmitting and receiving set. Ralph Bransby, Woodstock, Ill.

Bargain—New Single Circuit Regenerative 2 step amplifier set. Bulbs, B Batteries, Phones, Description—Photo—request. Distant Broadcasting brought in. $90. Oscar Bonter, Cambridge Springs, Penna.

200-20,000 Meter Receiver, including Radiotron, $35. Box 205, Williamsport, Pa.

Two Movie Cameras—First class condition. Must sell cheap. Joseph Dorothy, 517 West 148th St., New York City.

Used Radio Apparatus bought, sold. Apparatus made to order. Fordham Radio Exchange, 2018 Webster Ave., Bronx, N. Y.

Sell 1 KW Type R. Thordarson, twenty-five dollars. Oil emersed Condenser, fifteen dollars. Thordarson Rotary Gap, five dollars. C. W. Set two 5 watt capacity (the original first prize set—see Sept. Q S T page 25), sixty dollars. Will exchange for 50 Watt Set. 419 Cottage Ave., Glen Ellyn, Ill.

For Sale or Trade. Complete motorcycle and sidecar outfit. Want 2 step amplifier, etc. John B. Gould, Alfred, N. Y.

Omnigraph, 15 dial, $20, Cabinet type coupler, 3000 M, $5. 4000 meter cabinet type coupler, $6. Loading coil, 6000 meter, $3.50. 1 in. spark coil, $3.25. Walter Huber, Bunker Hill, Illinois.

For Exchange: 30-30 Automatic Remington rifle, shot about a dozen times. New Goodell-Pratt Amateur bench lathe, 25 in., bed, 7 in. swing, with slide rest and other attachments; Want, Grebe C.R. 5 receiver and RORD detector and two stage amplifier, or a Grebe CR9 Receiver. J. H. Mosher, Glendive, Montana, Box 560.

Sale: Roller-Smith 0-600 DC Voltmeter with protective resistance $10, Westinghouse 0-250 milliameter $8, Weston 0-500 milliameter $9.50, Weston 0-3 filament ammeter $7, Westinghouse 0-3 filament ammeter $7, Weston 0-40 DC Voltmeter $8, General Radio 3000-meter wavemeter $15, high grade regenerative receiver with detector and two-step amplifier $70, Bell Gap $35, Packard ½ KW $12, two sections Dubilier .004 $25, Acme 50-watt CW transformer $9. All instruments in perfect working order. Call evenings or write. J. T. Maloney, 2079 Mapes Avenue, Bronx, N. Y.

Have Quantity Salesman's Sample Regeneratives for sale, half price. Just the set you want. Wonderfully efficient. Made of best materials by master craftsmen. Encased in beautiful grained leather covered cabinet. Easy to operate; no capacity effects. A wonder for CW and phone. Equals a Paragon. Will be placed on market soon, retailing at fifty-five dollars; will sacrifice samples at $24 each. This is a bargain! Every one in excellent condition; like new. Fully guaranteed. Grasp this opportunity—order one today—now! (Photo free.) Master Engineering Company, Omaha.

For Sale: or exchange for other radio apparatus, Navy Loose Coupler, and crystal detector. Write Joe Novotny, Claflin, Kansas.

Special Radio Storage Batteries, Edison. Lead all sizes. Radio Battery Service Station, 41 Bryant St., Malden, Mass. 1.K.M.

Wanted—Second hand receiving outfit, complete with amplifier. J. W. Van Schaick, Highmore, So. Dak.

Exchange (Continued)

2 Jr. Omnigraph: A1 condition, $13. Arthur Williams, Jr., Holliston, Mass.

Clapp Eastham H.R. Regenerative Sets. Amplifiers, Loud Speakers Aerial Wire and Supplies. Special Discount to Every Reader of Radio News. Harry Welsh, Mayport, Penna.

Exchange—C. W. Complete 10 Watt sending set, bulbs, transformers, etc. Heard by DX stations. Bargain $75. C. Schrader, 3 Rockland Ave., Yonkers, N. Y.

Electrical Supplies and Appliances

Electric Tattooing Outfits, Illustrated Catalog, 10c. Waters Mfg., 1050 Randolph, Detroit.

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Tobacco or Snuff Habit Cured or no pay; $1 if cured. Remedy sent on trial. Superba Co., S.B., Baltimore, Md.

Pyorrhea (Rigg's disease—bleeding or swollen gums)—hundreds have been helped by "Pyorrdent" the successful home pyorrhea treatment. Purifying, healing, preventative. Full month's treatment, consisting of a very beneficial massage paste and an antiseptic tooth-cleansing paste to be used in place of your ordinary dentifrice, together with full directions for treatment. $1 postpaid. Or write for free booklet "R." Pyorrdent Mfg. Co., 439 Seventh St., Brooklyn, N. Y.

Radiate with life, be alert, improve your physical condition, send 10c for my booklet which explains everything. Jacob Hock, 2574 Madison St., Brooklyn, N. Y.

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Instruction

Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our full page ad on page 77 of this issue. Chemical Institute of New York, 140 Liberty Street, New York City.

Learn By Listening: We teach Hawaiian Guitar, Using Our Phonograph Records. Send for particulars. Roach-Frankland, 307 East Fourth St., Cincinnati, Ohio.

Manufacturing

Punch Press Radio work our specialty. B & W Mfg. Co., Schenectady, N. Y.

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Loft, 50x100, unrestricted light four sides, steam heat, large freight elevator, unrestricted use of roof. Ideal for manufacture or assembling of radio equipment. Van Been & Company, Inc., 413 East 109th Street, N. Y. City.

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Don't buy a Bicycle Motor Attachment until you get our catalog and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

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Cornetists, Trombonists, Saxophonists, Clarinetists, send for "Free Pointers," mention instrument. Virtuoso School, Buffalo, N. Y.

Patent Attorneys

Patent Application Filed on Partial Payment Plan. Trade-marks, copyrights, etc. Milo B. Stevens & Co., 694 F Street, Washington, D. C. Estab. 1864.

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Herbert Jenner, Patent Attorney and Mechanical Expert, 624 F St., Washington, D. C. I report if patent obtainable and exact cost. Send for circular.

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Crystal Set that gets radio concerts. Build it right, boys. Plans and full instructions for building at low cost, high grade, fine adjustable Crystal Receiving Set, fifty cents postpaid. Dept. RN, Shaw Mfg. Co., Galesburg, Kansas.

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Song Writers!—Learn of the public's demand for songs suitable for dancing and the opportunities greatly changed conditions offer new writers, obtainable only in our "Song Writers' Manual and Guide," sent free. Submit your ideas for songs at once for free criticism and advice. We revise poems, compose music, secure copyright and facilitate free publication or outright sale of songs. Knickerbocker Studios, 319 Gaiety Bldg., New York.

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Telegraphy—(Morse and Wireless) and Railway Accounting taught thoroughly. Big salaries. Great opportunities. Oldest, largest school. All expenses low—can earn large part. Catalog free. Dodge's Institute, M St., Valparaiso, Indiana.

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Build Your Own Radiophone. Instruction book, ten cents. Radio Service Inst., U. S. S. Bank Bldg., Washington, D. C.

Boys! Don't Overlook This. The "Rasco" Baby Detector. Greatest detector ever brought out with molded base. Fully adjustable. See former advertisements in this publication, or our catalog. Detector with Galena Crystal, complete 50c, the same detector with Radiocite Crystal, 75c prepaid. Send for yours today. Radio Specialty Company, 96-98 Park Place, New York City.

Attention!—50 Vacuum tube hook-ups. The greatest collection of vacuum tube circuits ever brought under two covers at such insignificant cost. These diagrams will be found in the great "Rasco" catalog, which contains raw materials and parts in a greater profusion than any other catalog. 15c in stamps, or coin, will bring the catalog to you. Radio Specialty Co., 96-98 Park Place, N. Y.

Phones 2000 ohm $6, 3000 ohm $7. Variable Condenser $5.50, two slider Tuning Coil $4, Crystal Detector $1.25-$1.75, all guaranteed. Cash with order. Ask for new Part Price Sheet. Immediate shipments. S. H. Stover & Co., Chamber Commerce Bldg., Pittsburgh, Pa.

Spirola—Beautiful Cabinet Loud Speaker—$3.85. See page 167.

New Synchronous Motors: $27.50—¼ H.P.—220 volt, 1800 R.P.M. Also ⅛ and ¼ H.P.—110 and 220 volt synchronous motors at very low prices. Stock limited—order at once. Stahl Rectifier Company, 1405 W. Jackson Blvd., Chicago, Ill.

Wireless Course in 20 Lessons. By S. Gernsback, A. Lescarboura and H. W. Secor, E. E. Tells you everything you want to know about "Wireless"—theory, practice and history. A clear, concise course on every phase of this subject. 160 pages—350 illustrations, 30 tables. Stiff cloth cover, $1.75 postpaid. Experimenter Publishing Co., Book Dept., 53 Park Place, New York.

Wireless (Continued)

Build Your Own Wireless Telephone and Musical Receiver. Don't wait for a Set. We hear Chicago, 900 miles, fine on good nights. Pittsburgh, Newark and New York come in good and loud. You can do the same on a single bulb. There is Radio music in the air each evening, and the living voices of the artists can be reproduced in your own home and enjoyed by you and your friends. Are you satisfied with your receiving set or would you like to build one that will receive over 6,000 miles on a single bulb and quit experimenting? One that will be equal to any regardless of claims and price—with which you can hear Honolulu, California, German, South American, French and English stations and practically all of the high powered foreign and domestic stations, as well as amateur stations as far west as New Mexico, and the phone and music. Anyone can assemble this outfit and wire it up, and the remarkable ranges that may be obtained will surprise you. Why not make a set up to date and efficient? Don't experiment with unknown circuits. We will promptly mail you our sample diagram of a complete short and long wave receiver, 175 to 20,000 meters, together with complete instructions for wiring and assembling, price of each part and where they can be bought, leaving nothing to guess about on receipt of fifty cents in coin or stamps. Here is a diagram no one can afford to be without. Virginia Novelty Co., Martinsburg, West Va.

Beginners! If receiving is your bugbear learn the language the headphones speak. By phonetically memorizing the continental code. Why visualize meaningless dots and dashes when radio is received by ear? Our instruction teaches code by sound alone, with special exercises for correlation of ear and hand, treatise on sending, and list of every combination of two letters or letter and numeral possible with English alphabet, for use in buzzer practice, postpaid upon receipt of one dollar. Money refunded if our instruction fails to increase your code-speed. H. H. Whitson, P. O. Box 344, Castner, Honolulu, H. T.

Several Army Airplane Sending Sets, as described in February Radio News, page 720. Army Field Telephones; Telegraph Sounders; Binding Posts; Magnet Wire, etc., cheap. A. W. Winterborne Laboratories, San Antonio, Texas.

Exceptional Bargains. Firth Detector, two step $33.75, Remler Control Panel $5, Titan 6-60 Battery $11, Western Electric Desk Telephone complete $10, Wall Telephone complete $7 or will exchange. Richard Devaney, Sharpsburg, Penna.

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Precession Variometers, $3.75, parts with hardware only not wound, $1.50. Variocouplers, $3, Parts, $1, Rotors bare 30c. Crystal detectors without crystal 50c. Stranded antenna wire, 60c. hundred feet. Wire, Supplies and parts. Send stamp for manufacturers' big bargain list. McConnell Cable and Specialty Co., 426 South Clinton St., Chicago, Ill.

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Radio Blueprints—Pocket Size. Twelve for 25c. Shows wave-lengths of aerials, the three fundamental hook-ups, meaning of symbols, various vacuum tube diagrams, and other useful information. Everyone needs this set as a ready reference. E. C. Barnes, 6207 Linden Ave., Seattle, Wash.

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Wanted—A few Western Electric VT-1's, VT-2's and head sets for use in our laboratory. Must be perfect. State quantity and lowest price. Reading Radio Shop, Box 6, Reading, Massachusetts.

Radio Supplies. We carry in stock a complete line of radio supplies. Everything from complete sets to aerial wire. Send us your orders for Cunningham Tubes. Eveready B batteries, Magnavox R 3. Loud Speakers and Power Amplifiers. Head Sets. Marshall-Gerken Variocouplers and Variometers, detector and amplifier panels. Crosley sockets and rheostats. Write or wire for real service. Rozum Motor Co., Mitchell, S. D.

Grebe Crystal Detector, $1.25; 23 Plate V.C., $2; Murdock Phones, $2; Loose Coupler, $5. Robert Cushman, Jr., Lime Street, Boston.

How to Make Wireless Sending Apparatus—100 pages—88 illustrations. Written and published entirely for the wireless enthusiast who wants to make his own radio apparatus. Contains more information on "how to make it" than any other book we know of. Paper bound, 35c postpaid. Experimenter Publishing Co., Book Dept., 53 Park Place, New York City.

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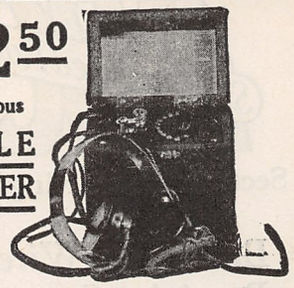

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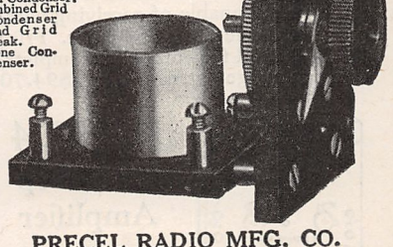

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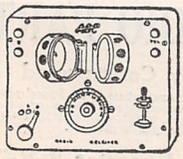

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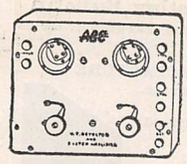

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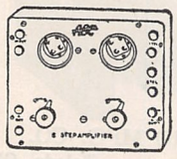

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A Man's Cream For a Man's Face

—is a true facial invigorator and tonic prepared for **men.** Two minutes' use brings the red blood tingling to the surface, removes that oily, sallow appearance and leaves the skin clean, clear, firm and with healthy color. It invigorates and hardens the facial muscles and promotes an alert, forceful expression. A sixty-day treatment—with money-back guarantee—will be sent to you for a dollar bill.

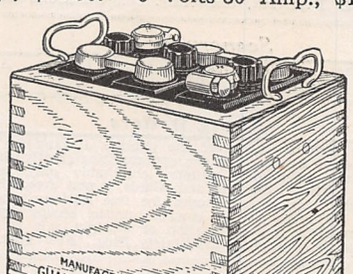
Manhood Commands Admiration

Men and women all admire the man whose face shows the clean vigor of perfect health. Stag is made for you men who want to be one of those ruddy, forceful, hard-hitting fellows who are always so popular. Send your name, address and a dollar and it will come to you by return mail —fully guaranteed.

Stag Laboratories 1267 Park Place, West Dept 716 Detroit, Mich.

RADIO "A" BATTERY

Guarantee Radio "A" Batteries give perfect service with minimum of attention. Handy, sure-contact screw post terminal. Leak-proof. Quickly recharged. Built to U. S. Govt. specifications. Prices: 6 Volts-60 Amp., $13.50. 6 Volts-80 Amp., $15.50.



Mail Orders Promptly Filled — **Screw Post Terminals**

GUARANTEE TIRE AND EQUIPMENT CO.
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Your skin can be quickly cleared of Pimples, Blackheads, Acne Eruptions on the face or body—Enlarged Pores, Oily or Shiny Skin. CLEAR-TONE has been Tried, Tested and Proven its merits in over 100,000 test cases.

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WE have Couplers, V, Meters, Dials, Knobs, Etc. Fibre cut to any size or shape. Brass rod, Machine screws and nuts. Machine screw taps.

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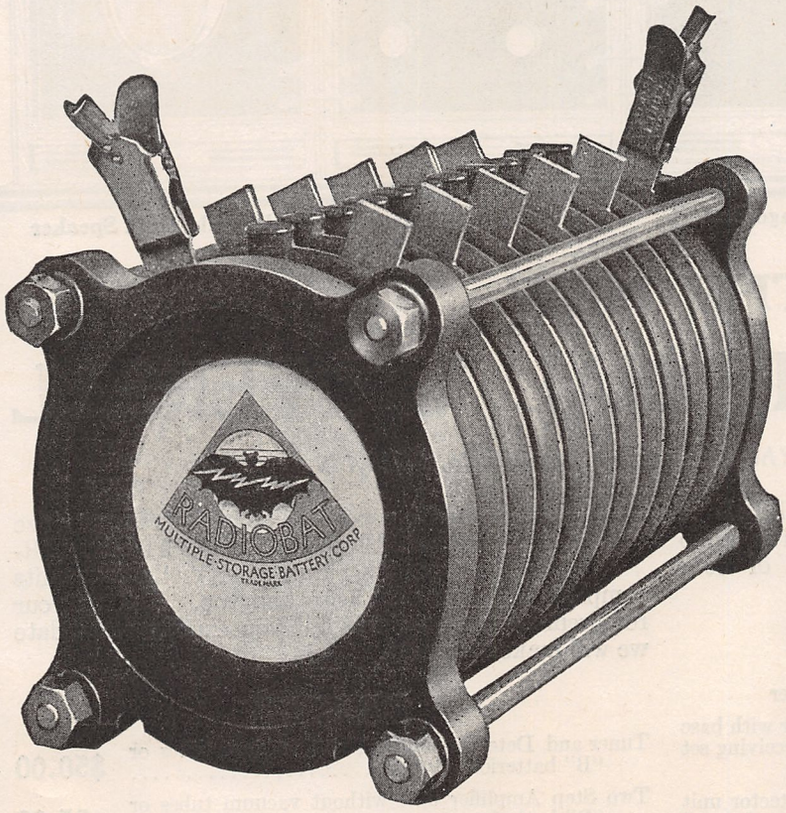
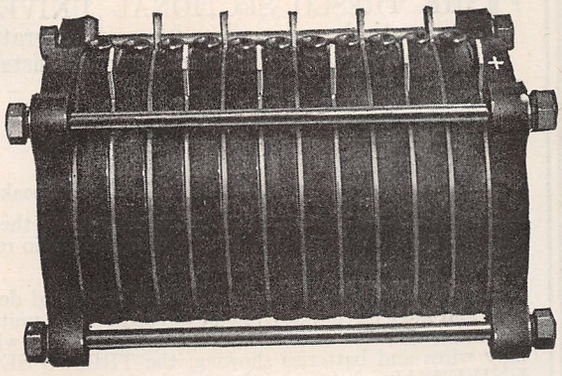
The Multiple Storage Battery Corporation Announces

RADIOBAT "B"

The Most Remarkable "B" Type Radio Battery Revolutionary in Design and Construction





RADIOBAT "B" is practically everlasting. It has no glass to break, no wooden case to rot, no separators of any kind.

RADIOBAT "B" is leak proof, is free from acid fumes.

Any voltage desired can be obtained simply and easily.

RADIOBAT "B" will give a clearer tone to your radio.

As Radiobat "B" has just been placed on the market, it is possible that your regular dealer may not be able to supply it. If this is the case, write us today enclosing $12.00, the price of this extraordinary battery.

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STORAGE BATTERY CORP.

ESTABLISHED 1908

350 Madison Avenue NEW YORK

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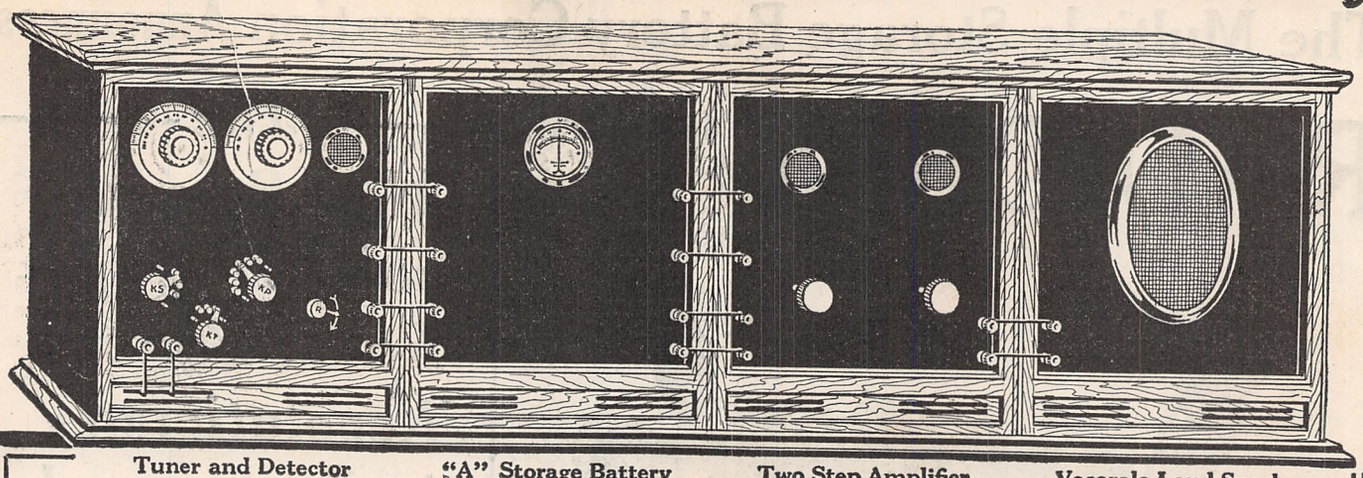
Ready for Immediate Delivery



Tuner and Detector | "A" Storage Battery | Two Step Amplifier | Vocorala Loud Speaker

THE NEW
TRESCO SECTIONAL UNIVERSAL

Licensed under the Armstrong Patent No. 1,113,149

THE TRESCO SECTIONAL UNIVERSAL is an entirely new idea in a regenerative radio receiving set. This receiver consists of four separate, distinct parts:

1. Tuner and Detector
2. Two Step Amplifier
3. Case for "A" Storage Battery
4. Case to fit the VOCORALA Loud Speaker

Each one is a separate unit and yet when put together with base and top, which is furnished, form a complete radio receiving set with all of the appearances of one case.

If you desire you can start with the tuner and detector unit only and later on add any one of the other three units. Instead of having different sized or different shaped boxes with a lot of ugly wires and batteries showing, the TRESCO SECTIONAL UNIVERSAL gives you the opportunity to secure a high-grade radio receiving set with no wires or batteries exposed. All of the units are made of oak, finished in French Gray, making an extremely attractive piece of furniture—something you would be proud to have in your home.

$112.00

Tuner and Detector **Case for "A" Battery**
Two Step Amplifier **Case for Vocorala**

Without tubes, batteries, Vocorala Loud Speaker or head set

TRESCO TUNERS are not new. They were one of the first tuners ever made under the Armstrong patent. Up to the present time our production has been very small, but nevertheless TRESCO TUNERS are today in use in every country in the world and especially where requirements call for long distances. TRESCO SECTIONAL UNIVERSAL is exactly the same type tuner and two step amplifier that we have been selling for many years—the only difference is the case. We believe that the time has come when the radio receiving set should be something more than an ordinary series of cracker-boxes connected with a lot of wires and batteries on the floor.

TRESCO REGENERATIVE TUNERS are made as extremely simple as possible. They are especially adapted for those who know nothing whatever about operating a radio receiver. The involute coil which is used in these tuners has been successfully used by us for the past seven years and it will successfully receive code, voice or music from 160 to 600 meters and do so with the very smallest number of adjustments.

WE are now in a position to take care of any size order on the TRESCO SECTIONAL UNIVERSAL, either for separate units or the four units complete together with base and top. Tell us your requirements and we will tell you exactly what date we will make shipment.

PRICES

Tuner and Detector unit without vacuum tubes or "B" batteries	$50.00
Two Step Amplifier unit without vacuum tubes or "B" batteries	35.00
"A" Battery unit without batteries	9.50
Loud Speaker unit made to fit Westinghouse Vocorala, but furnished without Vocorala itself	7.50
Top and Bottom unit which when added to the four other units makes complete case all in one. Each	5.00
Total cost of entire six units outlined above	112.00

The four units when placed side by side are 50″ long, 14″ high and 10″ deep.

TRESCO SECTIONAL UNIVERSALS are being supplied to the dealers and jobbers just as fast as possible. Order from your local dealer. If he cannot supply you we will gladly fill your order upon receipt of prices as given.

Dealers and jobbers are rapidly finding out that TRESCO is today one of the very few manufacturers who is actually in position to take care of large volume orders for immediate shipment. Liberal discounts are given to jobbers and dealers for quantity orders. We do not furnish vacuum tubes, batteries or loud speakers.

We are also desirous of securing well established salesmen who can represent us everywhere; also practical radio men for service stations.

LITERATURE FREE

TRESCO

DAVENPORT **J. MATHESON BELL, Sales Manager** **IOWA**

THE PERIODICAL PRESS, NEW YORK

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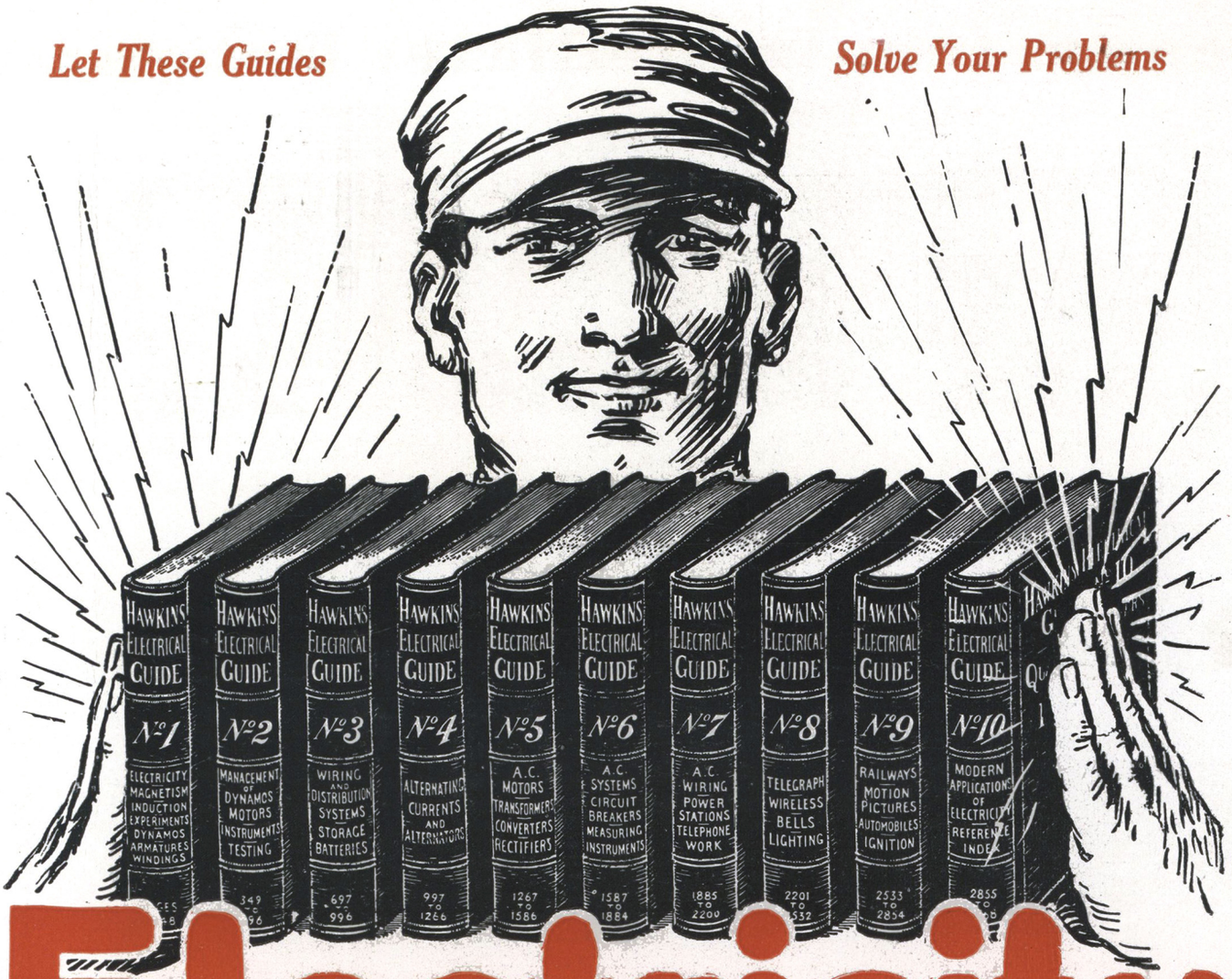

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Become a Radio-trician

Radio-trician means to Radio what
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THE world is aflame with Radio. Never before in the history of the country has an industry leaped to the forefront as rapidly as this great, new science. Hundreds of thousands of radio receiving sets are in operation—tens of thousands of sending stations will be erected—and this enormous craze is permanent. Even today manufacturers are months behind their orders! Improvements are being made every day which must increase the demand for radio equipment to even *greater* proportions than now.

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